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NP-4422 2564
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EFFECT OF COPPER ADDITIONS ON THE PLASTIC PROPERTIES OF AN Al-Zn ALLOY. C. D. Starr and J. E. Dorn. Jan. 1, 1953. 12p. (NP-4422; Technical Report No. 23)

NP-4433 2639
Carnegie Inst. of Tech.
THEORY OF NUCLEAR REACTIONS INVOLVING POLARIZED DEUTERONS. W. Lakin and L. Wolfenstein. [nd] 33p. (NP-4433)

NP-4435 2565
Armour Research Foundation
SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS. INTERIM TECHNICAL REPORT NO. 3 [FOR] JUNE 1, 1952–NOVEMBER 30, 1952. R. W. Hanzel and V. Pulsifer. [nd] 45p. (NP-4435; WAL-401/84-20; Interim Technical Report No. 3)

NP-4439 2566
Lehigh Univ.
STRESS-RUPTURE AND CORROSION TESTS OF TYPE 347 STAINLESS STEEL IN MOLTEN EUTECTIC LEAD-BISMUTH ALLOY; FIRST ANNUAL REPORT FOR THE PERIOD JUNE 1, 1951 TO MAY 31, 1952. Francis H. Laxar. May 31, 1952. 10p. (NP-4439)

NP-4440 2608
California Inst. of Tech.
NOTE ON THE USE OF CONICAL SOURCE GEOMETRY IN

THE HOMOGENEOUS FIELD AXIAL FOCUSING MAGNETIC β-RAY SPECTROMETER. Jesse W. M. DuMond, Pierre E. Marmier, and James R. Wilts. [Feb. 1953] 11p. (NP-4440)

NP-4442 2567
Massachusetts Inst. of Tech.
1. FUNDAMENTAL DEFORMATION CHARACTERISTICS OF 80 NICKEL-20 CHROMIUM ALLOY IN CREEP AT ELEVATED TEMPERATURES. 2. AGING IN NICKEL-CHROMIUM ALLOYS HARDENED WITH TITANIUM AND ALUMINUM. PERIODIC STATUS REPORT NO. 2 [FOR] NOVEMBER 1952 – FEBRUARY 1953. H. C. Chang, R. Nordheim, and N. J. Grant. [nd] 8p. (NP-4442; Periodic Status Report No. 2)

NP-4444 2576
Research Lab. of Electronics, Mass. Inst. of Tech.
A BIBLIOGRAPHY OF INFORMATION THEORY (COMMUNICATION THEORY — CYBERNETICS). F. L. Stumpers. Feb. 2, 1953. 48p. (NP-4444)

NP-4451 2591
Colorado Univ.
ENERGY DISTRIBUTION IN LUMINESCENCE SPECTRA OF ORGANIC COMPOUNDS. PROGRESS REPORT [FOR] SEPTEMBER 1, 1952 TO JANUARY 31, 1953. Frank E. E. Germann. [nd] 11p. (NP-4451)

NP-4452 2548*
Institute of Engineering Research, Univ. of Calif., Berkeley
FLOW METERING OF MOLTEN LEAD-BISMUTH EUTECTIC AT UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA. R. A. Seban, W. T. Schrank, and D. Bartz. Apr. 25, 1949. 11p. (NP-4452)

NRL-Memo-130 2553
Naval Research Lab.
THE THERMAL PROPERTIES OF SODIUM HYDROXIDE AND LITHIUM METAL; FOURTH PROGRESS REPORT [FOR] NOVEMBER 1, 1952 TO JANUARY 31, 1953. R. R. Miller. Mar. 1953. 7p. (NRL-Memo-130; Progress Report No. 4)

PR-P-16-E 2611
Chalk River Project (Canada)
PROGRESS REPORT [FOR] OCTOBER 1 – DECEMBER 31, 1952: ELECTRONICS BRANCH. J. Hardwick. 17p. (PR-P-16-E)

TEM-434 2559
Geological Survey
RECONNAISSANCE OF THE CLINTON FORMATION IN NEW YORK, PENNSYLVANIA, MARYLAND, AND NEW JERSEY. R. W. Schnabel and Rollin C. Vickers. Jan. 1953. 12p. (TEM-434)

WADC-TR-52-236 2569
Bureau of Mines
UNITED STATES BUREAU OF MINES ZIRCONIUM ALLOY INVESTIGATION. E. T. Hayes, R. L. Carpenter, A. D. Cavett, H. Kato, W. L. O'Brien, and O. G. Paasche. Nov. 1952. 32p. (WADC-TR-52-236)

WAL-401/146 2571
Watertown Arsenal Lab.
ELECTROPLATING ON TITANIUM; FIRST PROGRESS REPORT. Charles Levy. July 8, 1952. 24p. (WAL-401/146; Progress Report No. 1)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 May 15, 1953 No. 9

GENERAL

ATOMIC BOMBS AND WAREFARE

2453

RADIOACTIVE DUST FROM NUCLEAR DETONATIONS. Merril Eisenbud and John H. Harley. Science 117, 141-7 (1953) Feb. 13.

The Atomic Energy Commission has set up a monitoring program to measure the changes in radioactivity levels throughout the United States caused by nuclear detonations. The monitoring system is described briefly, data taken after the test, in the spring of 1952, at the Nevada Proving Grounds are analyzed, and some general conclusions as to radiation hazards of fallout are drawn. Radiation doses received from settled radioactive dust are minute compared to the exposure received in a lifetime from natural sources of radioactivity. (G.Y.)

RESEARCH PROGRAMS

2454

Oak Ridge Inst. of Nuclear Studies

QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1–DECEMBER 30, 1952. [nd] 35p. (ORO-88)

This report is essentially administrative in scope. Educational activities for the quarter are summarized. Use was made of the logarithmic counting-rate meter in conjunction with the scintillation spectrometer and Brown recorder in further investigation of the half life and γ-ray spectrum of thermal-neutron-irradiated Ti and Ir. The half-life study by this method indicated the existence of two short-lived activities (half life ~18 and 30 hours). A comparison of the recorded spectrum of Ir and the isotopically-pure Ti dioxide (Ti^{51}) shows remarkable coincidence between the various γ-ray energies. Included are copies of three papers by members of the Medical Division. Cellular Changes in Effusions Following Intracavitary Administration of Colloidal Au^{198} in Humans, has been accepted for publication in Cancer; A Note on Shaped Sources for Teletherapy Units, has been accepted for publication by Radiology; and Preparation of Dosages of I^{131} for Oral Administration, has not yet been submitted for publication. (C.H.)

2455

ORGANIZATION AND STAFFING OF THE MATERIALS TESTING REACTOR PROJECT. R. L. Doan. Nucleonics 11, No. 3, 10-13(1953) Mar.

The activities are listed and general discussion is given of the staffing of each branch. The functions of the various committees and the general philosophy regarding operational procedures are discussed. (L.M.T.)

BIOLOGY AND MEDICINE

2456

Columbia Univ.

THE GENETICS OF HOMEOSTASIS IN DROSOPHILA. Th. Dobzhansky, Columbia Univ. and Bruce Wallace, Biological Lab., Cold Spring Harbor. [nd] 14p. (AECU-2432)

Studies of genetic mechanisms which underlie homeostasis in natural and experimental populations of Drosophila are reported. Data on sensitivity to environmental variations shown by homozygotes and heterozygotes for chromosomes derived from natural populations and for chromosomes derived from experimental populations of Drosophila indicate that heterozygotes are more uniformly successful in a variety of environments than homozygotes. Implications of the findings upon the development of populations are discussed. (C.H.)

2457

INTRACAVITY AND INTERSTITIAL ADMINSTRATION METHODS FOR RADIOACTIVE COLLOIDAL GOLD. J. E. Stapleton and W. J. Wingo. Nucleonics 11, No. 3, 60-2 (1953) Mar.

Methods are described for dispensing and using colloidal Au^{198} that effectively reduce the exposure of personnel while requiring relatively little special apparatus. (auth)

2458

PREPARATION OF MICROAUTORADIOGRAPHS WITH THE USE OF STRIPPING FILM. W. E. Lotz and P. M. Johnston. Nucleonics 11, No. 3, 54(1953) Mar.

A modification of the usual stripping-film techniques is reported. Sections are prepared by appropriate methods and mounted on clean glass slides without H_2O flotation. If paraffin is used, the slides are placed in an oven at 54 to 56°C until the paraffin surrounding the tissue is melted and the tissue spreads. After drying for 2 to 3 hr, the slides are deparaffinized in two changes of xylol and then passed into dioxane where they are left. Under prescribed safelight conditions strips of emulsion 3 in. long and wide enough to cover the emulsion are floated on H_2O for 3 or 4 min. The slide bearing the section is brought up underneath the emulsion by alternately tipping the slide from side to side as the emulsion is lifted from the H_2O. The overlap on the back holds the section securely in place for the subsequent drying, exposure, developing, and washing processes. The overlapping emulsion can then be scraped off, and if desired the autoradiograph may be inverted by returning the slide to H_2O, since the section will adhere to the emulsion as it floats free. (L.M.T.)

2459

DETECTION OF AN α EMITTER IN HISTOLOGICAL SPECIMENS BY FLUORESCENCE PHENOMENA. I. Friedrich Ludwig. Compt. rend. 236, 751-3(1953) Feb. 16. (In French)

Detection of an α-labeled substance in a histological section by treating the section with any of various fluorescent materials is discussed. 25 references. (G.Y.)

2460

DETECTION OF AN α EMITTER IN HISTOLOGICAL SPECIMENS BY FLUORESCENCE PHENOMENA. II. Friedrich Ludwig. Compt. rend. 236, 972-4(1953) Mar. 2. (In French)

Detection of α-emitter-labeled substances in tissue sections by impregnation with fluorescent compounds in organic solvents is interfered with by the solubility of colored fats, chlorophyll, and other fluorochromes. This difficulty can

be overcome by impregnating the tissues with a colloidal solution of the fluorescent compound in water by means of electrophoresis. (G.Y.)

RADIATION EFFECTS

2461

Applied Fisheries Lab., Univ. of Wash.

A DESCRIPTION OF TUMORS ON IPOMOEA TUBA FROM THE A-BOMB TEST SITES ON ENIWETOK ATOLL; APPENDIX TO RADIOBIOLOGICAL SURVEY OF BIKINI, ENIWETOK, AND LIKIEP ATOLLS, JULY–AUGUST 1949. Susann F. Biddulph and Orlin Biddulph. [1952] 24p. (AECD-3446(app.); UWFL-23(app.))

Tumors on plants of Ipomoea tuba, a vine with large heart-shaped leaves and a stem which grows prostrate on the ground to a length of some ten meters, found in an area 400 to 600 yd from the bomb crater on an Eniwetok atoll 17 months after an atomic explosion, are described in detail. After careful consideration of all posible causal agents, it was concluded that the tumors were radioinduced. (C.H.)

2462

EFFECT OF PROLONGED ADMINISTRATION OF RADIOACTIVE ZINC^{65} ON THE PANCREAS. James W. Sherrill and Arne N. Wick. J. Lab. Clin. Med. 41, 40-42(1953) Jan.

Radioactive Zn^{65} acetate was administered weekly to rats for a six-month period. No diabetic symptoms, such as loss of body weight, glycosuria, or high blood sugar resulted from the radioactivity. (auth)

2463

EFFECTS OF IRRADIATION ON EMBRYONIC DEVELOPMENT. II. X-RAYS ON THE NINTH DAY GESTATION IN THE RAT. James G. Wilson, H. Charles Jordan, and Robert L. Brent. Am. J. Anat. 92, 153-87(1953) Jan.

Rat embryos on the 9th day of gestation were exposed to doses of 25 to 400 r of x rays directly through an abdominal incision in the mother. Lead plates were arranged so that selected embryos could be irradiated while the mother and remaining embryos were shielded. The irradiated and non-irradiated embryos were removed one to 8 days later or at term and compared as to weight, the presence of malformations, and the rate of intrauterine mortality. Exposure to 25 r resulted in microphthalmia in a very few instances but otherwise had no effect on embryonic development. Dosage with 50 r caused a slight retardation in the rate of growth and resulted in ocular maldevelopment or anophthalmia in 34% of animals. The brain and spinal cord also were malformed in a few instances. Irradiation with 100 r was followed by a considerable increase in mortality and, in the survivors, caused a marked retardation of growth which, however, became less pronounced as the post-irradiation interval increased. Some type of ocular abnormality was present in 90% of the animals. Malformations in other organs were less frequent but still occurred with considerable regularity in the brain, spinal cord, face, heart, and aortic arches. Situs inversus and anomalies of the urinary system were encountered occasionally. Many of these defects were found as often in term animals as in embryos removed at earlier ages; but anomalies involving the central nervous system and the cardiovascular system were less frequent in term animals and appeared to be associated with, if not responsible for, the high rate of prenatal mortality. Virtually all embryos receiving 200 r died within 4 days after treatment, and a large majority of those given 400 r died within 24 hours. The over-all effects of irradiation on the 9th day of gestation were more severe than those following treatment on the 10th day, owing presumably to the greater susceptibility of the less-differentiated 9th-day embryo to mitotic delay and genic alterations. (auth)

2464

RADIOACTIVITY INDUCED IN YEAST BY 100 MEV X-RADIATION. G. C. Baldwin and Leonard B. Clark. Science 117, 9-10(1953) Jan. 2.

Blocks of yeast were irradiated with x rays from the 100-Mev betatron. Samples were counted by means of a special device for the study of short-lived activities with which counting could begin 0.2 sec after a precisely timed irradiation. No short-lived activities of $0.5 < T < 125$ sec were induced. The resulting activity was due to O^{15}, C^{11}, and N^{13}. Their initial proportions, 1.00, 0.013, and 0.16, were in agreement with calculations for the counting geometry employed. Type K film placed in the yeast recorded less than 0.005 r after an irradiation to a total dose of 3050 r, the film exposure being such as to collect 60% of the total delayed dose. This is obviously a negligible fraction of the original dose. (G.Y.)

2465

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF 200 KV AND 23.5 MEV X-RADIATION. II. COMPARISON OF THE LETHAL EFFECT FOR YEAST. T. P. Ting, H. F. Chinn, and H. E. Johns. Rev. can. biol. 11, 389-400(1952) Dec.

The lethal effect of 23.5-Mev x radiation was compared with that of 200-kv x radiation in four strains of yeast. Results indicate biological effectiveness is dependent upon the formation of intermediate products in the neighborhood of the genes. (C.H.)

2466

HISTOCHEMICAL CHANGES IN IRRADIATED OVARIES. I. SUCCINIC DEHYDROGENASE ACTIVITY. Alvan G. Foraker, Sam W. Denham, and M. Harlan Johnston. Arch. Path. 55, 147-53(1953) Feb.

The left ovaries of 12 rabbits were subjected to external 200-kvp irradiation for a single dose of 400 r. Four weeks later six of the rabbits were used in negative and six in positive Friedman tests. Tissue from all ovaries was incubated in neotetrazolium with succinate to demonstrate succinic dehydrogenase activity. The results showed little evidence of irradiation damage to stromal cells, either in general pattern or in succinic dehydrogenase activity, as manifested by formazan deposition in irradiated and non-irradiated ovaries. Obliteration of most of the ova in irradiated ovaries was observed and those remaining were largely atretic, with little follicle-cell formation. Little evidence of ability of the irradiated ovaries to respond to the hormonal stimulation of the Friedman test was demonstrated. (auth)

2467

THE RADIATION TOLERANCE OF AN ADULT WASP. Robert L. Sullivan and Daniel S. Grosch. Nucleonics 11, No. 3, 21-3(1953) Mar.

The effects of various x-ray dosages and ingested P^{32} on the parasitic wasp Habrobracon were investigated. X-ray dosages of less than 108,150 r produced no visible effects, and 144,200 to 180,250 r caused sluggishness from which recovery was noted in ~30 min. Actually, both males and females showed an increased life span following x-irradiation. The life span was not demonstrably affected by P^{32} ingestions of 100 and 250 $\mu c/cc$. 15 references. (L.M.T.)

2468

RADIATION INJURY OF THE KIDNEY. P. W. Davey, J. D. Hamilton, and H. D. Steele. Can. Med. Assoc. J. 67, 648-50 (1952) Dec.

A renal lesion consisting of marked tubular degeneration, vascular injury and interstitial scarring with slight glomerular hyalinization is presented as an example of chronic radiation injury in one of the deeply seated so-called radioresistant organs. The picture is similar to that seen in

early hydronephrosis but in the case presented there was no evidence of obstruction anywhere in the urinary tract and no dilatation of the ureters or pelves. The irradiation was carried out in the course of therapy for secondary malignancy of the spine and the total tumor dose was 4700 r in the kidney region. It should be stressed that heavy irradiation of the abdomen or spine in the region of the kidneys may do irreparable damage to renal structure and function. (auth)

2469

LYMPHOCYTE STRUCTURAL MODIFICATIONS FROM EFFECTS OF IONIZING RADIATION. Sebastián Núñez Mier y Terán. Bol. Liga contra cancer 26, 146-65(1951) Oct. (In Spanish)

Data are analyzed on lymphocyte changes in 45 persons, divided into three groups: (1) 15 healthy controls never exposed to radiation, (2) 10 patients treated for cancer with x rays or Ra, and (3) 20 hospital personnel, possibly exposed incidentally to ionizing radiation. (G.Y.)

2470

COMPARISON OF LOCAL AND SYSTEMIC EXPOSURES IN PRODUCTION OF RADIATION CATARACT. A. C. Upton, K. W. Christenberry, and J. Furth. Arch. Ophthalmol. (Chicago) 49, 164-7(1953) Feb.

Opacities of the lens were readily induced in mice by x radiation, the threshold dose being somewhat less than 15 r. The opacities increased in severity with the dose and time after irradiation, the incidence of lesions approaching 100% at 33 weeks after exposure to doses of 45 r or more. Cataract did not occur if the head was shielded from radiation, although the remainder of the body received doses as large as 405 r, a result supporting the view that cataract induction depends upon irradiation of the eye itself. The induction time, progression, configuration, and severity of opacities were approximately the same after exposure of the head alone as after total-body irradiation, indicating that protection of the eyes against cataract is not afforded by shielding the remainder of the body. (auth)

2471

HISTOLOGICAL CHANGES IN THE TISSUES OF THE HIBERNATING MARMOT FOLLOWING WHOLE BODY IRRADIATION. Kirkland C. Brace. Science 116, 570-71 (1952) Nov. 21.

Results of histological studies of the thymus, testes, spleen, and bone marrow of the hibernating marmot following whole-body irradiation are summarized in tabular form. Comparison with data from histological studies of nonirradiated hibernating and irradiated non-hibernating controls indicate a retardation in the development of radiation damage in the hibernating marmot. The relationship of the rate of cell division to the appearance of radiation injuries is discussed. (C.H.)

2472

EFFECT OF X-RAYS ON MICRONUCLEAR NUMBER IN PARAMECIUM AURELIA. R. P. Geckler and R. F. Kimball. Science 117, 80-1(1953) Jan. 23.

Following x irradiation of P. aurelia, the fraction with less than two micronuclei was found to increase with increasing dose, the fraction with two micronuclei was found to decrease, and no unequivocal change was observed in the group with more than two micronuclei. The effect of such variation on results in genetic studies obtained with P. aurelia is discussed. (C.H.)

2473

PRELIMINARY REPORT ON ANEMIA IN MICE RESULTING FROM IRRADIATION OF THE EXTERIORIZED SPLEEN. Bruce Allen. Nucleonics 11, No. 3, 44-5(1953) Mar. (cf. ANL-4401(p. 31-2); NSA 5-2027)

After anesthetizing 22-month old CF_1 mice, the spleen was exteriorized with as little trauma as possible. An x-ray dose of 1025 r was administered in 3.5 min to the exteriorized spleen, the rest of the body being shielded. The mice were grouped as follows: (1) no operation, total-body x irradiation, (2) spleen exteriorized, total-body x irradiation (including spleen), (3) spleen exteriorized but not irradiated, and (4) spleen exteriorized and x-irradiated (rest of body shielded). Blood samples were taken daily and the red-cell counts for each group are shown for 7 days. Results indicate a greater degree of anemia produced in the mice in which only the exteriorized spleen was irradiated. (L.M.T.)

2474

EFFECT OF NATURAL MICRORADIOACTIVITY OF CAPILLARY PERMEABILITY. Camillo Bonessa. Minerva med., 832-4(1952) Nov. 1. (In Italian)

Rabbits were given, by mouth, daily doses of the natural radioactive waters of Merano, Italy. Capillary permeability changes were followed with fluorescein injections. Several interpretations of the permeability-inhibiting effect of the radioactive waters are proposed. (G.Y.)

RADIATION HAZARDS AND PROTECTION

2475

RESEARCH ON THE VARIATIONS OF RADIOSENSITIVITY INDUCED BY CHEMICAL SUBSTANCES; QUANTITATIVE ASPECTS OF THE PROTECTIVE ACTION OF CYSTEINE ON THE LETHAL EFFECTS OF X RAYS IN E. COLI. Carissimo Biagini and Vinci Grossi. Rev. biol. (Perugia) 44, 493-510(1952) Oct.-Dec (In Italian)

Effects of varying the x-ray dose, the concentration of the protective agent, and the pH of the medium on the lethal action of x rays on cultures of E. coli commune were investigated. Some experiments were carried out on bacteria dried in vacuum. In all cases a very significant inverse correlation was found between the log surviving fraction and x-ray dose. About 87% of the lethal effect was attributed to the indirect action and ~13% to the direct action of the x rays. The results are discussed in detail. (G.Y.)

2476

EXTENSION TO MAN OF EXPERIMENTAL WHOLE-BODY IRRADIATION STUDIES; SOME MILITARY AND CIVIL DEFENSE CONSIDERATIONS. Franklin C. McLean, John H. Rust, and Ann M. Budy. Military Surgeon 112, 174-82 (1953) Mar.

Data from experimental whole-body irradiation studies with animals are reviewed from the standpoint of predicting the response of man to irradiation under certain conditions of military and civil defense importance. The $LD_{50/30}$ for man exposed to a single dose of 250-kvp x rays is calculated as 400 ± 100 r on the basis of such data as are available. (C.H.)

2477

RADIATION EXPOSURE IN THE UNITED STATES. Dade W. Moeller, James G. Terrill, Jr., and Samuel C. Ingraham. Public Health Repts. 69, 57-65(1953) Jan.

Sources of radiation to which the average person living in the United States may expect to be exposed during an average lifetime are reviewed, and the hazards of exposure to radioactive materials and radiation-generating units in commerce, industry, and research are discussed. The need is stressed for training public health personnel to meet the problems presented by technological developments in the field of atomic energy. (C.H.)

2478

PROTECTIVE MECHANISMS IN IONIZING RADIATION INJURY. Harvey M. Patt. Physiol. Revs. 33, 35-76(1953) Jan.

A comprehensive review is presented of present concepts of the nature of radiobiological effects and protective mechanisms in ionizing-radiation injury. 377 references. (C.H.)

RADIOGRAPHY

2479

THE RADIOGRAPHY OF THE HUMAN BODY WITH RADIOACTIVE ISOTOPES. W. J. Oosterkamp. Brit. J. Radiology 26, 111-12(1953) Feb.

Calculations are presented which lead to the conclusion that 5 c of a radioactive material, emitting one photon per disintegration, emits the same number of photons as an x-ray tube loaded to 1 watt, if only x-ray photons with more energy than half the limit energy are considered. The characteristic data for several radioactive elements are given in tabular form. Data indicate that the use of radioisotopes, even if short-lived and carrier-free, is only attractive in medical radiography for those applications where the use of x-ray tubes is not practicable. (C.H.)

RADIOTHERAPY

2480

Radioisotope Lab., Montefiore Hospital, New York

ANNUAL REPORT [ON] LANTHANUM AND OTHER RARE EARTH ELEMENTS, CALCIUM AND PHOSPHORUS IN CANCER [FOR] MAY 1, 1951–APRIL 30, 1952. [nd] 134p. (AECU-2425)

The reaction of La, Nd, Pr, Sm, and Y with the high-polymer Na salt of desoxyribonucleic acid was studied by spectrophotometric and tracer methods and the elementary composition of the insoluble complexes produced and the tentative structure of the compounds formed are reported. Attempts to prepare rare-earth porphyrin complexes are discussed. Data are reported on the distribution of La in normal and tumor-bearing animals as a function of time, dose, route of administration and the chemical state of the element. The potential significance in cancer therapy of observations made with rare-earth radioisotopes is discussed. Data are presented on the distribution of a tracer amount of La^{140} in a patient with osteogenic sarcoma. Intraperitoneally injected La^{139} and La^{140} chloride significantly decreased the rate of mortality and the number of cancer cells in mice bearing Ehrlich ascites tumors. Distribution studies made following intrapleural injection of 6 mc of La^{140} to a patient with metastatic pleural carcinoma indicate concentration of the isotope onto the wall of the pleural cavity. Progress is reported in studies on the effect of La on nucleic acids of cells, histochemical analysis of the livers of mice killed at periodic intervals following a single injection of La, and studies on mineral metabolism in human cancer. A Ca tolerance test is described which correlates well with bone metabolic data and is responsive to changes in bone metabolism as induced by treatment. (C.H.)

2481

THE USE OF COBALT 60 IN GAMMA-RAY THERAPY. E. M. Japha. Amer. J. Roentgenol. Radium Therapy Nucl. Med. 69, 445-65(1953) Mar.

The physics of Co^{60} is reviewed and the requirements for sheathing interstitial Co^{60} sources discussed. A calculation is made of the secondary radiation induced in such sheaths and electroplated layers in terms of photoelectrons and first-order recoil electrons. It is pointed out that this secondary β radiation corresponds to an equivalent of 35 "μc" per mc of Co^{60} of which more than 50% is highly energetic (0.6 to 1.25 Mev). A program of acquiring a series of sources with at least two linear intensities different by a factor of 2 : I is outlined. The problems of dose determination, absorption and protection are discussed. The dose distribution around 0.3 mm-steel-sheathed Co^{60} is presented in the form of iso-intensity curves. Butter bleaching experiments are described which show that, for this effect at least, there exists essential similarity of action between linear sources of radium and Co^{60}. (auth)

2482

CLINICAL USE OF RADIOACTIVE PHOSPHORUS IN THE TREATMENT OF VARIOUS HEMOPATHIES. P. Lamarque and E. Thibaud. J. radiol. électrol. 33, 501-4(1952) (In French)

Results obtained over several years in the treatment of blood diseases characterized by polyglobulism or of chronic lymphoid and myeloid leukoses with P^{32} are summarized. For the three Vaquez's diseases, 12 to 15 mc in several doses gave significant remissions, now lasting 6 to 10 months. Results obtained in five cases of lymphoid leukemia seem excellent. In one case, a remission to date of 18 months is noted. Myeloid leukemias seem more resistant to P^{32}, particularly when the patients have already been submitted to other treatments (x rays or chemotherapy). However, for a patient in which the myeloid leukemia had been discovered early, P^{32} caused a clear improvement, now lasting 6 months. (tr-auth)

2483

AN APPARATUS FOR THE INTRAPERITONEAL INJECTION OF RADIOACTIVE COLLOIDAL GOLD. R. C. Tudway. Brit. J. Radiology 26, 108-9(1953) Feb.

An easily sterilized apparatus is described which has been successfully used for the intracavitary injection of colloidal Au^{198} into patients. A series of three connected flasks, two of which contain saline, is fitted at one end with a bulb to control air pressure and at the other with a needle or canula for insertion into the cavity. After sterilization, a shielded flask containing the sterile Au^{198} solution is substituted for one saline flask. A series of clamps adjusts the flow and allows for washing all the Au^{198} into the patient. (C.H.)

TOXICOLOGY STUDIES

2484

Boyce Thompson Inst. for Plant Research, Inc.

QUANTITATIVE STUDIES ON THE ROLE OF HYDROGEN SULFIDE FORMATION IN THE TOXIC ACTION OF SULFUR TO FUNGUS SPORES, by Lawrence P. Miller, S. E. A. McCallan, and Richard M. Weed. [1953] 34p. (AECU-2430)

Quantitative studies of the rate of H_2S production and the total quantity produced before ability to germinate was lost are reported for spores of nine species and two strains of fungi exposed to elemental S. It was found that the rate at which spores could absorb S and give off H_2S was greatly influenced by the physical state and formulation of the S used. Commercially formulated sulfurs were three to five times as active as the best sample of pure S. A colloidal preparation was taken up about nine times as readily as the most active commercially formulated sample tested. Results suggest that the rate of H_2S production is a good test of the efficacy of a formulation and that S may exert its effect through its action as a hydrogen acceptor and its interference in the normal dehydrogenation and hydrogenation reactions of the spores. (C.H.)

2485

USE OF CALCIUM ETHYLENEDIAMINETETRAACETATE IN TREATING HEAVY-METAL POISONING. Arch. Ind. Hyg. Occupational Med. 7, 137-47(1953) Feb.

A conference is reported where research and clinical problems associated with the use of Ca ethylenediaminetetraacetate in accelerating the excretion of lead and other heavy metals in the treatment of metal poisoning were discussed. (C.H.)

TRACER APPLICATIONS

2486

California Univ., Davis Coll. of Agriculture

MEANING OF TURNOVER. Max Kleiber. [nd] 3p. (AECU-2421)

Hevesy (Radioactive Indicators. N.Y., Interscience Publishers, 1948, p.249) considers the determination of the rate of renewal, or turnover, as one of the most important applications of tracers. A clear definition of the term "turnover" is, therefore, of obvious interest. A recent discussion in the Davis Team for Metabolic Research with Tracers showed that some of us applied this term to one, others to another, concept and both could defend their terminology by use in previous publications from scientists in our University. Zilversmit, Entenman, and Fishler (J. Gen. Physiol. 26, 325(1943)) and later other workers in Chaikoff's laboratory (Feller, Shisover, and Chaikoff. J. Biol. Chem. 187, 576(1950); Searle and Chaikoff. Am. J. Physiol. 170, 456(1952)) use turnover rate as synonym to rate of disappearance. According to this definition, turnover rate has the dimension amount/time. Siri (Isotopic Tracers and Nuclear Radiation. N.Y., McGraw Hill, 1949, p.395) on the other hand uses turnover rate as the reciprocal of turnover time. According to his definition, therefore, turnover rate has the dimension 1/time; it is Zilversmit's rate divided by pool content. Even though it may not have seniority, Siri's terminology is preferable because it is more logical. We may speak of transfer rate or exchange rate from one pool to another or rate of disappearance from one pool and can say for example how many atoms (or grams) of P are exchanged per unit of time or disappear from a pool per unit of time; but we are not justified to say that a number of P atoms turned over, at least that is not what we mean in tracer work. The question, how many times these P atoms turn over per unit of time, might possibly be tackled by nuclear physicists. In tracer work, we are concerned with the turning over of a P pool. The turnover rate is the number of times a given pool of P atoms turns over or is renewed per unit of time. As the turnover rate of a wheel (presumably the original for the analog) is the linear velocity of the car divided by the circumference of the wheel, so the turnover rate of a metabolic pool is the transfer rate divided by the pool content. To facilitate discussion in our team for tracer work, we express specific activities with Greek letters, amounts with capital Latin letters and rates with small Latin letters. We thus formulate the exchange between two pools studied by a tracer as $d\alpha_1/dt = a(\alpha_1 - \alpha_2)/A_1$. Assigning the symbols to the concepts, (with dimensions given in brackets), α_1, α_2 = specific activities in pool 1 and pool 2 (concentration), a = rate of transfer = rate of exchange (amount per unit of time), A_1 = pool content (amount), a/A_1 = turnover rate of pool 1 ($time^{-1}$), and A_1/a = turnover time for pool 1 (time). For a first order process the turnover rate is the same as the rate constant in the terminology of chemical kinetics. The renewal rate is a synonym to turnover rate and the same argument applies for its definition; we do not mean to say that so and so many atoms are renewed per unit time because not the atoms are renewed but the pool. The renewal rate therefore tells how many times a pool is renewed per unit of time, which is the exchange rate divided by the pool content. (Entire report)

2487

Sloan-Kettering Inst. for Cancer Research

ON THE HETEROGENEITY OF THE DESOXYRIBONUCLEIC ACIDS. Aaron Bendich, Percy J. Russell, Jr., and George Bosworth Brown. [nd] 34p. (AECU-2428)

A procedure has been developed by means of which the desoxyribonucleic acid (DNA) of rat small intestine, spleen, pancreas, kidney, brain, testis, and regenerating liver has been separated into at least two fractions differing in solubility in 0.87% NaCl. The DNA of normal adult rat liver has yielded only one fraction by this procedure. The ratio of the insoluble (DNA_1) to the soluble fraction (DNA_2) has been found to vary from organ to organ. Some of the implications of these findings have been discussed in the light of the presumed participation of DNA in genetic phenomena. Certain aspects of the metabolism of these DNA fractions and the PNA have been studied with the aid of C^{14}-formate. Evidence has been presented which indicates that the two DNA fractions are metabolically dissimilar. The unequal extent of incorporation and apparent retention of isotope in the bases of individual DNA fractions have suggested that the DNA's have a heterogeneous metabolic origin. These results also suggest that there is no uniform pattern of biosynthesis for the DNA's of all organs. (auth)

2488

Oklahoma Agricultural Experiment Station

STUDIES ON THE EFFECT OF AERATION ON NITRATE REDUCTION BY PSEUDOMONAS USING N^{15}. Richard O. Marshall, Henry J. Dishburger, Robert MacVicar, and Glenn D. Hallmark. Oklahoma Agricultural Experiment Station and Texas Agricultural and Mechanical Coll. Research Foundation. [nd] 13p. (AECU-2429)

Metabolism of nitrate by Pseudomonas fluorescens and Pseudomonas dentrificans has been studied by quantitative evaluation of the N composition of rapidly growing cultures and by use of the stable N isotope, N^{15}. These organisms, adapted to nitrate by long serial subculture, reduced nitrate when exposed to air in shallow layers of media and when vigorously aerated. Loss of nitrate-N occurred which was presumably due to conversion to gaseous products. Simultaneous addition of ammonia and nitrate ions did not prevent the reduction of nitrate or its conversion to a volatile compound. Increase in cellular N was closely correlated with removal of ammonia from the media. When nitrate and ammonia were present simultaneously, NH_4^+ was assimilated preferentially and converted to cellular components, as demonstrated by the small isotope concentration of the cells when $N^{15}O_3$ was supplied and the rapid incorporation of $N^{15}H_4$ into the cellular fraction. This supports the view that ammonia constitutes an intermediate in the reduction of NO_3^- to cellular nitrogen. Disappearance of NO_3^- from media, and conversion to gaseous form, however, was essentially unaffected by the presence of NH_4^+. (auth)

2489

Atomic Energy Project, Univ. of Calif., Los Angeles

SOIL-PLANT INTERRELATIONSHIPS WITH RESPECT TO THE UPTAKE OF FISSION PRODUCTS. I. THE UPTAKE OF Sr^{89}, Cs^{137}, Ru^{106}, Ce^{144}, AND Y^{91}. James W. Neel, Jon H. Olafson, Allen J. Steen, Barbara E. Gillooly, Hideo Nishita, and Kermit H. Larson. Mar. 9, 1953. 44p. (UCLA-247)

The relative uptakes of Sr^{89}, Cs^{137}, Ru^{106}, Ce^{144} (determined in the presence of their daughter products), and Y^{91} from several soils, contaminated at rates of 100 dis/sec/g, by a variety of plants were investigated. Two soils were contaminated with each of the five fission products and the relative uptakes of barley, carrot, lettuce, bean, and radish plants grown to maturity determined. Sr^{89} and Cs^{137} uptakes were confirmed by the growth of the same plants in two additional contaminated soils of different characteristics. The magnitudes of uptake of Sr^{89} and Cs^{137} during the growth period by barley plants grown in five highly variable soils were determined. The uptakes of Sr^{89} by all plants exceeded those of Cs^{137} and Ru^{106} by at least one order of magnitude; the uptakes of Ce^{144} and Y^{91} were negligible. Highest specific activities of Sr^{89}, Cs^{137}, and Ru^{106} occurred in leaves of all

plants; where examined, the activities of seeds were extremely low and roots generally lower than corresponding aerial parts. Highest specific Sr^{90} activities occurred in bean and radish leaves and lowest in barley leaves. In the series demonstrating highest uptake, specific activities ranged from 500 dis/sec/g of barley leaves to 1420 dis/sec/g of bean leaves. The rates of uptake of Sr^{90} and Cs^{137} were closely related to rates of growth. Variations in Sr^{90} uptake as great as two-fold were attributable to soil differences. Correlations with clay type and presence or absence of $CaCO_3$ were not complete. (auth)

2490

A METABOLISM UNIT DESIGNED FOR RADIOISOTOPE BALANCE STUDIES WITH DOGS. Sam L. Hansard. Science 117, 301-2(1953) Mar. 20.

A metabolism cage was designed for balance studies with dogs that effects the satisfactory quantitative separate collection of urine and feces eliminated by either sex. This was accomplished by an arrangement of a circular false floor that comfortably supports the animal above the wire mesh during the experimental period and keeps him oriented in such a way that all feces pass through the annular opening and are collected below on the removable mesh floow. (L.T.W.)

2491

TECHNICAL MODIFICATIONS OF RADIOCARDIOGRAPHY. Aldo A. Luisada, Abraham R. Goldfarb, Giano Magri, and Robert Saffian. Science 117, 299-300(1953) Mar. 20.

Radiocardiography was described in 1948 by Prinzmetal et al. (Science 108, 340(1948)) and its clinical applications were presented a year later (Prinzmetal et al., J. Am. Med. Assoc. 139, 617(1949)). Several disadvantages in the method as originally proposed brought about the modifications which are described. Twenty mc of I^{131} in the form of diiodofluorescein were injected into one of the antecubital veins. A Bi γ G-M tube contained in a directional Pb shield was used. The tube was suspended from a vertical stand, and the shield opening was placed ~1 in. from the center of the precordium. The tube was connected to a count-rate meter whose outlet was connected to a direct-writing electrocardiograph with 4 channels. An electrocardiograph and a carotid or brachial tracing were recorded with the radiocardiogram, indicating the number of cardiac cycles necessary for the isotope to go through the right or left side of the heart. Experiments on dogs and humans showed that a large monophasic wave, lasting 1 to 4 sec, occurs within 2 to 6 sec after injection of the isotope. After ~1 to 3 sec, a second monophasic wave occurs, lasting 2.5 to 4 sec, often preceded by a smaller wave. Sometimes, after the end of the second large wave, more waves are visible, frequently occurring in couples. Possible explanations of these phenomena are presented. (L.T.W.)

2492

AUTORADIOGRAPHIC AND HISTOCHEMICAL OBSERVATIONS ON THE MINERALIZATION OF TEETH IN RATS AND HAMSTERS OF VARIOUS AGES. Leonard F. Bélanger. Anat. Record 114, 529-54(1952) Dec.

An autoradiographic survey of what happens in time to a tracer dose of P^{32} in the teeth of rats and hamsters of various ages is reported. (auth)

2493

TECHNIQUE OF PHARMACOLOGICAL ANIMAL EXPERIMENTS IN APPLICATION OF RADIOACTIVE ISOTOPES. M. Frimmer. Angew. Chem. 65, 126-31(1953) Mar. 7. (In German)

Apart from the usual peculiarities of isotope chemistry, numerous biological conditions are important for pharmacological experiments with animals. For this reason a brief review is given regarding the possibilities and technique of such experiments. (tr-auth)

2494

AUTORADIOGRAPHIC DETECTION OF INCORPORATION OF P^{32} INTO CHROMOSOMES DURING MEIOSIS AND MITOSIS. J. H. Taylor. Exptl. Cell Research 4, 164-73 (1953) Feb.

A technique for detection of incorporation of P^{32} into individual nuclei is described. P^{32} is shown to be incorporated into the nuclei or chromosomes during only a relatively short part of the interphase. Evidence that this corresponds to the period of DNA synthesis is presented. Using the evidence on P^{32} incorporation along with the available data on the species constancy of DNA per chromosome set, the time of its increase as measured by other methods, and the time of chromosome reproduction as indicated by x-ray breakage, it is tentatively concluded that the period of P^{32} incorporation corresponds to the time of chromosome reproduction and that the DNA is a part of the permanent framework of the chromosome. It is further shown that incorporation of P^{32} into the PNA of individual cells can be measured by the use of radioautographs. This incorporation is correlated with periods of rapid accumulation of synthesized materials in the cytoplasm and may in turn be related to the cell cycle. (auth)

CHEMISTRY

2495

Iowa State Univ.

THE BEHAVIOR OF ORGANIC COMPOUNDS AT THE DROPPING MERCURY ELECTRODE IN NON-ASSOCIATED ANHYDROUS SOLVENTS; PROGRESS REPORT NO. 2. Stanley Wawzonek, Reynold A. Berkey, Eli Blaha, and Francis D. Thomson. Feb. 27, 1953. 23p. (AECU-2427; Progress Report No. 2)

The behavior of stilbene and quinones in acetonitrile at the dropping Hg electrode is illustrated by chemical equations. The polarographic behavior of various organic compounds in dimethylformamide was found to be similar to that observed in acetonitrile. The polarographic results obtained from organic compounds in methanesulfonic acid are summarized and indicate that the triarylcarbonium ions formed from triarylcarbinols and the conjugate acids of aromatic aldehydes, ketones, and 1,1-diphenylethylene are reducible at the dropping Hg electrode. (L.T.W.)

2496

Ames Lab.

MANGANESE(II), (III), (IV) EQUILIBRIUM IN IODIC ACID. Glenn R. Waterbury and Don S. Martin, Jr. June 1952. 72p. (ISC-238)

The Mn(II), (III), (IV) equilibrium in iodate solutions from 0.25 to 1.78M has been studied using spectrophotometric and potentiometric titration methods. Colorimetric methods were used for directly analyzing solutions containing Mn(III) and Mn(IV) and for showing that the establishment of the equilibrium was rapid. Potentiometric methods were used to determine the magnitude of the concentration equilibrium constant under various experimental conditions. The equilibrium was found to be dependent on the fourth power of the iodate ion concentration and the third power of the hydrogen ion concentration. Probable formulas for the complex species involved in the equilibrium reaction were postulated and the over-all reaction was written as follows: $MnO(OH)(IO_3)_4^{-3} + Mn^{++} + 3H^+ + 4IO_3^- \rightleftharpoons 2Mn(IO_3)_4^- + 2H_2O$. Using activity coefficient data for iodic acid solutions, an approximate equilibrium constant for the above reaction of 2.5×10^{12} at 0°C was obtained from a

graphical extrapolation of the data to zero ionic strength. A ΔH° of −11 kcal was calculated. (auth)

2497

Thermochemical Lab., National Bureau of Standards

THE HEAT OF FORMATION OF BORON TRICHLORIDE. Walter H. Johnson, Richard G. Miller, and Edward J. Prosen. Jan. 15, 1953. 16p. (NBS-2257)

The heat of formation of gaseous boron trichloride has been determined by direct reaction of gaseous chlorine with amorphous boron in a calorimeter.

$$B(\text{amorph}) + \tfrac{3}{2}\, Cl_2(\text{gas}) = BCl_3(\text{gas})$$

$$\Delta H^\circ(25^\circ C) = -97.51 \pm 0.32 \text{ kcal/mole}$$

Utilizing the values previously reported for the heats of formation of boric acid, diborane, and pentaborane, there are obtained the heat of solution of boron trichloride:

$$BCl_3(\text{liq}) + 4003H_2O(\text{liq}) = [H_3BO_3 \cdot 1000H_2O](\text{liq}) + 3[HCl \cdot 1000H_2O](\text{liq})$$

$$\Delta H^\circ(25^\circ C) = -69.1 \pm 0.5 \text{ kcal/mole}$$

and the heats of reaction of diborane and pentaborane with chlorine:

$$B_2H_6(\text{gas}) + 6Cl_2(\text{gas}) = 2BCl_3(\text{gas}) + 6HCl(\text{gas})$$

$$\Delta H^\circ(25^\circ C) = -334.1 \pm 0.8 \text{ kcal/mole}$$

$$B_5H_9(\text{gas}) + 12\, Cl_2(\text{gas}) = 5\, BCl_3(\text{gas}) + 9\, HCl(\text{gas})$$

$$\Delta H^\circ(25^\circ C) = -699.1 \pm 1.7 \text{ kcal/mole}$$

Using an estimated value for the heat of sublimation of boron, the average bond energy of the B-Cl bond in boron trichloride is 93 kcal. The data on the heats of formation of diborane, boric oxide, boric acid, and boron trichloride now form a consistent set of values. (auth)

2498

Fordham Univ.

PROGRESS REPORT [COVERING WORK DONE FROM APRIL 1, 1951 TO APRIL 1, 1952], CHEMISTRY DEPARTMENT. M. Cefola, J. J. Draney, C. F. Ferraro, and B. R. Miccioli. Apr. 1, 1952. 13p. (NYO-723)

Amperometric methods for the determination of SH groups have not yielded reproducible results. A method is described for the preparation of α thio keto acids. Studies of the chelation properties of organic S compounds are in progress and a method is described for the preparation of isocysteine. Results of qualitative investigations of the color reactions of a number of cations and anions with thiosalicylic acid are summarized. Preliminary data are included from a study of the extraction of Ni with thenoyltrifluoroacetone as a function of pH. (C.H.)

2499

Oak Ridge National Lab.

GENERAL INFORMATION CONCERNING HYDROXIDES. Mary E. Lee. Issued Mar. 18, 1953. 23p. (ORNL-1495)

This report is an addition to ORNL-1291. It includes abstracts taken from Chemical Abstracts (Sect. 4, 1952, through Sect. 22, 1952) containing information concerning the hydroxides of Ba, Ca, Cs, Li, Mg, K, Rb, Na, and Sr. (auth)

ANALYTICAL PROCEDURES

2500

Oak Ridge National Lab.

THE USE OF A CATION EXCHANGE RESIN FOR ANION ANALYSIS OF URANYL SALTS IN WATER. H. O. Day, J. S. Gill, E. V. Jones, and W. L. Marshall. [Mar. 1953]. Decl. with deletions Mar. 16, 1953. 4p. (AECD-3506; CF-53-3-38)

The ion-exchange analytical method in water involving the removal of cations by an exchange resin and a subsequent titration of the acid eluate has been extended to include some anions of uranyl salts — the sulfate, nitrate, chloride, perchlorate, and dichromate. The method was found to offer much promise because of the speed and precision of analysis. (J.E.D.)

2501

Michigan Univ.

POLAROGRAPHIC BEHAVIOR OF THENOYLTRIFLUOROACETONE (TTA) AND RELATED COMPOUNDS. ALKALINE CLEAVAGE OF TTA. COMPLEXATION OF TTA WITH BORATE. ANALYTICAL DETERMINATION OF TTA. Philip J. Elving and Clarence M. Callahan. Michigan Univ. and Pennsylvania State Coll. Jan. 15, 1953. 41p. (COO-119; Tech. Report No. 1)

Thenoyltrifluoroacetone (TTA) gives two polarographic waves in chloride, acetate, and ammonia buffers, but only one wave in borate and phosphate buffers. The absence of one wave in the latter media is attributed to the complexation of TTA with buffer components. By correlating the half-wave potentials and behavior of TTA with those of thiophene, acetothienone, thenoylacetone, trifluoroacetylacetone, and acetylacetone, each TTA wave is assigned to the reduction of a definite carbonyl group in the compound. The polarographic evidence indicates the first wave to be due to a one-electron reduction of the carbonyl group adjacent to the trifluoromethyl group, followed by dimerization to form the pinacol. The second wave is due to the reduction of the thenoyl carbonyl group to the carbinol. An analytical study showed that the diffusion current is a linear function of the concentration; optimum analytical results are secured in acetate buffer. The trends and anomalous effects in the polarographic behavior of TTA are discussed. The alkaline fission of TTA in ammonia buffer was followed polarographically; the data indicated a zero-order reaction. The nature of the interaction between boron species and the carbonyl group adjacent to the trifluoromethyl group is examined. The complex resulting is possibly due to the formation of a four-membered ring between boron and the two hydroxyl group oxygens on the carbon of the hydrated carbonyl group. (auth)

2502

FLUORINE DETERMINATION BY DISTILLATION AS H_2SiF_6 WITH RECYCLING OF THE WATER. G. Pietzka and P. Ehrlich. Angew. Chem. 65, 131-5(1953) Mar. 7. (In German)

An apparatus for the analysis of F has been developed in which the water required for the distillation of the H_2SiF_6 is recycled. The problem of unsupervised distillation has thus been solved with simple means. A newly elaborated rapid method allows the subsequent volumetric determination of the F, after precipitation as Pb bromofluoride, to be carried out within 10 to 15 min. (tr-auth)

2503

METHOD FOR DETERMINATION OF SMALL AMOUNTS OF RARE EARTHS AND THORIUM IN PHOSPHATE ROCKS. Claude L. Waring and Henry Mela, Jr. Anal. Chem. 25, 432-5 (1953) Mar.

In laboratory investigations, interest developed in the possible rare-earth content of phosphate samples from Florida and the northwestern U. S. Because of the difficulty of making chemical determinations of traces of individual rare earths, a combined chemical-spectrographic method was investigated. After removal of iron by the extraction of the chloride with ether, the rare earths and thorium are concentrated by double oxalate precipitation, using calcium as a carrier. The rare earths are freed from calcium by an ammonium hydroxide precipitation with a fixed amount of Al as a carrier. The Al also serves as an internal standard in the final spectrographic analysis. The

method will determine from 0.02 to 2 mg of each rare earth with an error no greater than 10%. The investigation has resulted in a fairly rapid and precise procedure, involving no special spectrographic setup. The method could be applied to other types of geologic materials with the same expected accuracy. (auth)

2504

ACTIVATION ANALYSIS. W. Herr. Angew. Chem. 64, 679-85(1952). (In German)

Neutron-activation analysis, with and without chemical separation; neutron-absorption analysis; and deuteron and proton activation are reviewed. 24 references. (G.Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2505

Knolls Atomic Power Lab.

THE ISOTHERMAL TRANSFORMATION OF METASTABLE BETA URANIUM SINGLE CRYSTALS. A. N. Holden. Nov. 19, 1952. Decl. Feb. 26, 1953. 45p. (AECD-3505; KAPL-831)

The transformation of metastable beta U crystals was found to proceed by a martensitic reaction at room temperature. The features of the transformation of particular interest were that individual U martensite plates formed isothermally and that they grew at a slow rate isothermally. (auth)

2506

Ames Lab.

STRUCTURE OF NEODYMIUM SULFATE OCTAHYDRATE. Donald R. Fitzwater and R. E. Rundle. June 1952. 50p. (ISC-241)

An evaluation of the problems of x-ray crystal-structure determination has led to the conclusions that a parallel-channel relay digital computer operating in conjunction with the standard I.B.M. units will meet the calculation needs of a structure determination and greatly shorten the time and labor involved. A brief description of a relay computer designed to meet these needs is given. The computer will be able to perform all of the calculations required with the exception of the Patterson and electron-density calculations. The structure of neodymium sulfate octahydrate has been partially determined. The x and z parameters are known well enough to give correlation factor of 0.22 for $F_{obsd.}$ and $F_{calcd.}$ The y parameters are known only approximately. On the basis of coordination radii and polyhedra projections, the coordination number of the neodymium ion is found to be nine. The coordination polyhedron is formed by adding oxygen out from the center of the three vertical faces of a triangular prism containing atoms at the six corners. A method for the detection of pyroelectric effects is described. The procedure is based on the rotation of a pyroelectric crystal from its dipole equilibrium position in an electric field when a temperature gradient is set up across the crystal. The detection of the pyroelectric effect leads to the selection of a non-centrosymmetric space group for the crystal. (auth)

2507

THE FLUORITE PHASE IN THE ThO_2-Y_2O_3 SYSTEM; ITS DEFECT STRUCTURE, ELECTRIC CONDUCTIVITY, AND ANOMALOUS LATTICE PERTURBATIONS. F. Hund and R. Mezger. Z. physik. Chem. 201, 268-77(1952) Dec. (In German)

Precipitated mixed Th and Y hydroxides were ignited to oxides at 1200°C. A cubic fluorite phase extends from pure ThO_2 up to ~30 mole % Y_2O_3, the lattice constant decreasing from 5.584 to 5.554 kX; at higher Y_2O_3 contents a two-phase region exists, the components being Y_2O_3 and a mixed crystal with a 5.558-kX lattice constant. The anomalous mixed crystals have intact cation lattices with vacancies in the anion lattice. Temperature dependence of the specific electrical resistance of ThO_2 and mixed crystals with 8 and 22 mole % Y_2O_3 were measured. The thermal-vibration type of lattice perturbation was measured for these preparations by the absolute method and was related to the defect structure and electric conductivity. (tr-auth)

2508

URANIUM ARSENIDES. II. CRYSTAL STRUCTURE OF UAs_2 AND UP_2. Aldo Iandelli. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 13, 144-51(1952) Sept.-Oct. (In Italian)

Complete structures for tetragonal UAs_2 and UP_2 have been determined from powder and oscillating-crystal x-ray-diffraction data. For UAs_2, a = 3.954 A, c = 8.116 A; for UP_2, a = 3.800 A, c = 7.762 A. (G.Y.)

2509

URANIUM-ANTIMONY ALLOYS. II. Riccardo Ferro. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 13, 151-7(1952) Sept.-Oct. (In Italian)

Complete crystal-structure data on USb_2 are presented. The compound is tetragonal with a = 4.272 A and c = 8.741 A. (G.Y.)

2510

URANIUM–ANTIMONY ALLOYS. I. Riccardo Ferro. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 13, 53-61(1952) July-Aug. (In Italian)

X-ray powder-diffraction data are given for USb and U_3Sb_4. USb is cubic with a_0 = 6.191 A; the structure is the same as that of UN, UP, UAs, and UBi. U_3Sb_4 is cubic with a_0 = 9.095 A; the complete structure is derived. (G.Y.)

2511

NEUTRON DIFFRACTION STUDY OF THE NaCl-TYPE MODIFICATION OF ND_4Br AND ND_4I. Henri A. Levy and S. W. Peterson. J. Chem. Phys. 21, 366(1953) Feb.

Powder neutron-diffraction studies of ND_4Br at 250°C and ND_4I at 23°C have been made in order to obtain information on the ammonium ion orientation. For both substances the freely rotating ion model is in disagreement with the observed data. Two different static models and the one-dimensional rotator all agree within experimental error. (G.Y.)

2512

URANIUM ARSENIDES. I. Aldo Iandelli. Atti. accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 13, 138-43 (1952) Sept.-Oct. (In Italian)

X-ray powder-diffraction data are given for UAs and U_3As_4. UAs has the NaCl-type cubic structure; a_0 = 5.766 A. U_3As_4 has the cubic Th_3P_4 structure with a_0 = 8.507 A; atomic coordinates are given. (G.Y.)

FLUORINE AND FLUORINE COMPOUNDS

2513

Oak Ridge National Lab.

GENERAL INFORMATION CONCERNING FLUORIDES. Mary E. Lee. Issued Mar. 17, 1953. 22p. (ORNL-1490)

This report is an addition to ORNL-1252. It is a compilation of abstracts, taken from Chemical Abstracts (Sect. 4, 1952 through Sect. 22, 1952), containing general information concerning the fluorides of Al, Ba, Be, Ca, Cs, Pb, Li, Mg, K, Rb, Na, Sr, and U. (auth)

2514

VAPOR PRESSURE OF SULFURYL FLUORIDE; SEPARATION FROM SULFUR HEXAFLUORIDE AND THIONYL FLUORIDE. Jean Neudörffer. Compt. rend. 236, 706-7 (1953) Feb. 16. (In French)

Vapor-pressure data for SO_2F_2 from −160 to −80°C are tabulated. The possibility of fractionation, and consequently quantitative analysis, of SO_2F_2 from SF_6 and SOF_2 is indicated. (G.Y.)

2515
ACTION OF FLUORINE ON THE SULFATE, SULFITE, AND THIOSULFATE OF SODIUM. Marius Picon and Louis Domange. Compt. rend. 236, 704-6(1953) Feb. 16. (In French)

Na_2SO_4 reacting with F_2 yields very slowly NaF, SO_2F_2, and O_2, starting at 100°C. Na_2SO_3 first yields Na_2SO_4, then the compounds already mentioned. $Na_2S_2O_3$ reacts at −40°C without incandescence. S, then SF_6, are obtained. Sulfite is formed transitorily and from it are finally produced SF_6, NaF, Na_2SO_4, SO_2F_2, O_2, and SOF_2. (tr-auth)

GRAPHITE

2516
THERMAL CONDUCTIVITY OF SYNTHETIC GRAPHITE RODS AT TEMPERATURES BETWEEN 3300 AND 3700°K. Joachim Euler. Naturwissenschaften 39, 568-9(1952) Dec. (In German)

LABORATORIES AND EQUIPMENT

2517
Knolls Atomic Power Lab.
A VERSATILE VACUUM MELTING FURNACE. Robert V. Gray. Jan. 1953. 19p. (KAPL-865)

A specially designed vacuum induction melting furnace operating at pressures 0.03 to 1.0 μ is described. The furnace capacity is ½ to 15 lb of steel. The metal may be cast in vacuum by tilt pouring, bottom pouring, or centrifugal casting. (auth)

RADIATION CHEMISTRY

2518
Argonne National Lab.
I. OXIDATION OF FERROUS SULFATE IN BORIC ACID SOLUTIONS BY IRRADIATION WITH THERMAL NEUTRONS. II. OXIDATION OF FERROUS SULFATE IN LITHIUM SULFATE SOLUTIONS BY IRRADIATION WITH THERMAL NEUTRONS. W. R. McDonell. Dec. 22, 1952. 13p. (ANL-4949)

In the irradiation of dilute solutions of ferrous ion and boric acid in 0.8N sulfuric acid with thermal neutrons at fluxes of 10^{10} and 10^{11} n/cm² sec and low γ fluxes there is found a linear relationship between the concentration of boric acid and the extent of radiation-chemical oxidation of ferrous ion by the products of the $B^{10}(n,\alpha)Li^7$ nuclear reaction. Within limits of experimental error, no variation is apparent in the yield of ferric ion per unit flux in the flux range investigated. The mean yield of product is $45.3 \pm 4.0 \times 10^5$ Fe^{+++} l^{-1} n^{-1} cm^2 per mole of H_3BO_3 and is equivalent to a G value of 4.3 ± 0.4 ferrous ions oxidized per 100 ev energy expended by the heavy-particle products of the nuclear reaction. A similar experiment is described for oxidation of $FeSO_4$ in Li_2SO_4. (auth)

2519
SUBSTITUTION REACTIONS OF BROMINE ACTIVATED BY NEUTRON CAPTURE. II. STUDY OF THE FORMATION OF BROMINE DERIVATIVES OF NITROBENZENE AND OF METHYL AND ETHYL BENZOATES. M. Ivanoff. Bull. soc. chim. France, 266-9(1953) Mar. (In French)

The bromination of nitrobenzene and methyl and ethyl benzoates by 34-hr Br^{82} activated by neutron capture has been studied to determine the energy state of the latter at the moment in which it attacks the aromatic nucleus. From the proportions of ortho, meta, and para isomers formed (bromonitrobenzene: o/m/p = 1.97/0.64/1; methyl and ethyl bromobenzoate: o/m/p = 20/2.5/1), the conclusion is drawn that the Br^{82} reacts after losing its kinetic energy. (tr-auth)

2520
DISTRIBUTION AND CHEMICAL REACTION OF RADIOACTIVE RECOIL ATOMS FROM THE (n,γ) PROCESS IN VARIOUS RHENIUM SALTS. Wilfrid Herr. Z. Elektrochem. 56, 911-17(1952). (cf. NSA 6-2041)

The excitation energy given to the Re ion by the (n,γ) reaction is of the order of magnitude of 1000 kcal. The Re* has a tendency to occur in the VII valence state, and can, therefore, be readily isolated. In neutron-irradiated solutions of Re salts the yield (~100%) is not dependent on concentration, pH value, or the presence of other ions. In crystals irradiated at room temperature, radicals of the type $[ReCl_6]^-$ are formed; the separable Re* being ~30%. When the irradiation takes place at liquid-air temperature the yield is higher At constant temperature, the retention reaches a constant, characteristic value for each temperature. The quadrivalent Re formed by isomeric transition of the Re^{186m} from the (n,γ) reaction can be isolated, analogous to a Szilard-Chalmers separation. (tr-auth)

RADIATION EFFECTS

2521
EFFECT OF HIGH-ENERGY RADIATION ON LONG-CHAIN POLYMERS. A. Charlesby. Nature 171, 167(1953) Jan. 24.

Polymers of polythene, polystyrene, terylene, nylon, and unvulcanized rubber were found to become cross-linked when subjected to high-energy radiation, with the degree of cross-linking produced being proportional to the radiation dose over a wide range of values. Decomposition of methyl methacrylate set in after a very short irradiation period. Detailed data are presented on effects of irradiation on polythene. Commercial implications, and advantages of this treatment in the study of long-chain polymeric structure, are discussed. (cf. NSA 7-1394, 7-1523.) (C.H.)

2522
HYDROGEN PEROXIDE FORMATION BY COBALT GAMMA-RADIATION. Thomas J. Sworski. J. Chem. Phys. 21, 375-6(1953) Feb.

Formation of H_2O_2 in air-saturated pure H_2O, air-saturated 0.8N H_2SO_4, and He-saturated 0.8N H_2SO_4 irradiated with Co^{60} γ rays is plotted as a function of time. The presence of a radical remover in the H_2SO_4 may explain the linearity of H_2O_2 formation observed in the acid solutions. The rate of H_2O_2 formation following complete ceric sulfate reduction is the same as that in air-saturated 0.8N H_2SO_4 and is stoichiometrically equivalent to the rate of ceric sulfate reduction. The rate of H_2O_2 formation following complete ferrous sulfate oxidation is the same as that in air-saturated 0.8N H_2SO_4. (G.Y.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2523
PREPARATION AND PROPERTIES OF CERIUM CYANAMIDE. Helmut Hartmann and Günter Dobek. Z. anorg. u. allgem. Chem. 271, 138-43(1953) Feb. (In German)

$Ce_2(CN_2)_3$ is prepared by passing HCN and NH_3 in a stream of N_2 at 880°C over CeO_2 prepared by a 400°C ignition of Ce oxalate. It is a yellow, crystalline substance, soluble in dilute mineral acids, which undergoes slow hydrolysis in H_2O. (tr-auth)

SEPARATION PROCEDURES

2524
Iowa State Univ.
PROGRESS REPORT NO. 1 [ON] SEPARATION OF AZEOTROPES BY MEANS OF DIFFUSION THROUGH POROUS MEMBRANES (thesis). Donald H. Hagerbaumer. Dec. 31, 1952. 199p. (AECU-2419)

Binary azeotropes can be separated by diffusion through a porous barrier, specifically porous glass. Eleven azeotropic systems were studied at atmospheric upstream pressure and ~0.008 atm. absolute downstream pressure,

including acetone-CH_3OH, cyclohexane-ethanol, benzene-isopropanol, benzene-n-propanol, benzene-CH_3OH, benzene-ethanol, ethanol-H_2O, isopropanol-H_2O, CCl_4-ethyl acetate, benzene-cyclohexane, and acetone-CS_2. The first 7 systems separated in the direction the azeotropes would follow when the pressure was reduced on the azeotrope. The last 4 systems separated in the opposite direction. The separation of vapors decreased if they were superheated. The vapor permeability constant increased as the upstream pressure was decreased. Superheating the vapor at constant upstream pressure decreased the rates of permeation. Permeability curves have the same general shape as adsorption isotherms. Capillary condensation and distillation partially contribute to the separation mechanism. Separation of the vapors varies with the amount of vapor passing over the membrane. The equations developed are inapplicable to the flow of vapors of benzene, methanol, and ethanol through porous glass. The first 8 systems listed did not separate according to the inverse ratio of the molecular weight, contrary to Graham's Law for ideal gases. The last three obey Graham's Law. All of the systems, except benzene-cyclohexane, separated in favor of the component possessing the lower critical pressure. (L.T.W.)

2525

Battelle Memorial Inst.

A MODIFIED HCl VOLATILIZATION METHOD FOR DETERMINING OXYGEN IN ZIRCONIUM. J. J. Tighe, A. F. Gerds, E. J. Center, and M. W. Mallett. Dec. 29, 1952. 13p. (BMI-799)

The method for the determination of oxygen in zirconium metal as described by Read and Zopatti has been modified to reduce the over-all operating time and to facilitate handling of the metal halides in the equipment during the reaction. Results comparable with the original method have been obtained. The apparatus and method are described. (auth)

2526

STUDIES ON ISOTOPES. PART I. THE ISOTOPIC COMPOSITION OF WATER WHICH HAS BEEN ENRICHED IN HEAVY ISOTOPES BY FRACTIONATION. H. A. E. Mackenzie and A. M. Milner. J. S. African Chem. Inst. 4, 57-62(1951) June.

An attempt has been made to obviate the need for determining experimentally the individual contributions of HDO and $H_2{}^{18}O$ to the excess density of water samples which have been enriched in heavy isotopes by fractionation. The theory leads to the conclusion that the platage of a fractionating column is greater for the separation of $H_2{}^{16}O$ and $H_2{}^{18}O$ than it is for the separation of H_2O and HDO. By introducing a single parameter, whose value is determined empirically, into the theory of the enrichment process, it is possible to calculate the composition of water which is derived from natural water by distillation processes only, provided that its density is known. (auth)

2527

STUDIES ON ISOTOPES. PART II. THE APPROACH TO ISOTOPIC EQUILIBRIUM DURING FRACTIONAL DISTILLATION WITH APPRECIABLE HOLD-UP IN THE STILL-POT. H. A. E. Mackenzie and P. N. Malherbe. J. S. African Chem. Inst. 4, 63-8(1951) June.

A modification of Urey's theory of the approach to isotopic equilibrium during fractional distillation, which can be employed in cases where there is appreciable hold-up in the stillpot, is shown to yield an adequate and useful representation of the facts. (auth)

2528

STUDIES ON ISOTOPES. PART III. THE PERFORMANCE OF STAINLESS STEEL GAUZE RING PACKING IN THE ISOTOPIC FRACTIONATION OF WATER. H. A. E. Mackenzie and P. N. Malherbe. J. S. African Chem. Inst. 4, 69-78(1951) June.

A laboratory still for the rectification of water is described. The still is constructed from cheap and readily available materials and embodies accessories which give close control of throughput and pressure drop and by means of which fresh water can be fed into the column to replace the isotopically light distillate. A 12-ft rectifying section is packed with $^1/_{16}$-in., 100 mesh stainless steel gauze rings. The results of several distillations show that this packing may be used to achieve useful enrichments of $H_2{}^{18}O$ and HDO, provided that low throughputs are employed. The characteristics of the packing have been studied in detail and the column has twice been run to isotopic equilibrium. The enrichments of heavy isotopes achieved in the two cases are equivalent to increases in density of 180 and 187 parts per million. The limiting boil-up rate has been found to decrease and the efficiency of the packing to increase with usage, presumably due to a cleansing action of the steam on the stainless steel surface. The performance of the stainless steel rings is markedly inferior to that claimed for the otherwise identical phosphor-bronze rings used by Dostrovsky and Hughes. The only likely explanation seems to be that the metals have different surface characteristics. Despite this, an H.E.T.P. of as little as 1.5 in. in the case of the oxygen isotopes has been achieved here. (auth)

2529

STUDIES IN ISOTOPES. PART IV. CATALYSIS OF ISOTOPIC EXCHANGE BETWEEN GASEOUS OXYGEN AND LIQUID WATER. H. A. E. Mackenzie and A. M. Milner. J. S. African Chem. Inst. 4, 79-83(1951) June.

Attempts have been made to catalyze the isotopic exchange between oxygen and liquid water under laboratory conditions. No appreciable exchange occurs in the presence of metallic oxides or hydroxides, or of organic substances capable of entering into oxidation-reduction reactions. It is established, however, that exchange does take place in the presence of H_2O_2 and of substances which catalyze the decomposition of H_2O_2. Since catalase, in particular, is one such substance and since this enzyme exists in all green plants, the fact that the oxygen produced during photosynthesis has the same isotopic composition as the water in which the plant is bathed can no longer be accepted as proof that the mechanism of photosynthesis involves the production of oxygen solely from the water. (auth)

2530

PHOSPHORUS COMPOUNDS IN THE CELL. 3. THE INCORPORATION OF RADIOACTIVE PHOSPHORUS INTO THE RIBONUCLEOTIDE FRACTION OF LIVER TISSUE. J. N. Davidson and R. M. S. Smellie. Biochem. J. 52, 599-606(1952) Dec.

In experiments with P^{32} the use of the procedure of ionophoresis on paper makes it possible to obtain nucleotides free from all traces of contaminating inorganic phosphate. When the ribonucleotide fraction obtained by the procedure of Schmidt and Thannhauser (1945) from the tissues of an animal receiving P^{32} is submitted to ionophoresis, at least six non-nucleotide phosphate derivatives can be detected as well as the four ribonucleotides. Their presence can conveniently be demonstrated by making autoradiographs of the ionophoretic run. One of these six concomitants is inorganic phosphate derived from phosphoprotein. The other five are organic phosphates. Two hours after administration of P^{32} to rats and rabbits the concomitants all have higher specific activities than the nucleotides. This accounts for the abnormally high specific activity of the Schmidt-Thannhauser fraction. A modified Schmidt-Thannhauser procedure involving partial isolation of the ribonucleic acid is

described which, in combination with ionophoresis, gives a true picture of the specific activities of the ribonucleotides. Ribonucleotides comprise only about 75% of the total phosphorus in the ribonucleotide fraction obtained from tissues by the Schmidt-Thannhauser procedure. (auth)

SPECTROSCOPY

2531

New Hampshire Univ.

[THE INFRA-RED AND ULTRA-VIOLET SPECTRUM OF BROMINE TRIFLUORIDE]. PROGRESS REPORT. Helmut M. Haendler. July 31, 1952. 28p. (NYO-3161)

The infrared spectrum of BrF_3 has been measured in the regions 2 to 15 μ and 16 to 25 μ, using several different window materials, none of which are completely resistant. Three bands have been observed, at 6.5 , 8.30, and 16.0 μ, although the first may not be due to BrF_3. The band at 8.30 μ is sufficiently sharp to be extremely useful as an analytical band, and the 16.0 μ band is broad enough to be a fundamental, although no resolution of fine structu. e has been effected. The ultraviolet spectrum of BrF_3 has been measured, using perfluoroheptane solutions. The fluoride absorbs in the region 230 to 270 mμ and any Br present shows as a band at 415 mμ. Quartz windows have been used, but fluorothene-coated silica seems promising. Development of windows for both methods is in progress. A technique for direct coating of fluorothene on glass, metal, and silica has been developed. Preliminary studies on systems with BrF_3 have begun. (auth)

2532

APPLICATION OF INFRARED ADSORPTION SPECTRA TO STUDY OF DEGREE OF CONDENSATION OF THE GROUP PO_3 IN METALLIC SALTS. I. TRIMETAPHOSPHATES. Jean Lecomte, André Boullé, and Marthe Dominé-Bergés. Translated by C. A. Horton from Bull. soc. chim. France 15, 764-70(1948). 10p. (AEC-TR-2011)

SYNTHESES

2533

Radiation Lab., Univ. of Calif., Berkeley

PREPARATION OF C^{14} LABELED DL-ASPARTIC ACID. R. M. Noller and B. M. Tolbert. Dec. 1952. 11p. (UCRL-2041)

Aspartic-3-C^{14} acid hydrochloride has been prepared by a method that is also suitable for the preparation of aspartic-4-C^{14} acid hydrochloride. A procedure has been developed by which the aspartic acid may be purified without the use of ion-exchange columns. (auth)

2534

HYDROLYSIS PRODUCTS OF NUCLEIC ACIDS LABELED WITH TRITIUM; PREPARATION BY BIOSYNTHESIS. M. L. Eidinoff, H. C. Reilly, J. E. Knoll, and D. H. Marrian. J. Biol. Chem. 199, 511-16(1952) Dec.

Nucleic acid hydrolysis products were prepared from yeast grown in a nutrient medium containing tritium. Adenine, guanine, cytosine, and uracil, all containing this isotope, were prepared from the yeast sodium nucleate. Since one step in this procedure involves the treatment of the nucleate with 70% perchloric acid at 100°, it is evident that hydrogen atoms in the 8 position in guanine, the 2 or 8 position (or both) in adenine, and the 4 or 5 position (or both) in cytosine and uracil have a substantial resistance to isotopic exchange in aqueous media. The principal source of carbon in the nutrient medium was sodium acetate. A variety of highly radioactive compounds can be prepared by this biosynthetic method, since the growth is manifold and since acetate labeled with radiocarbon or tritium in the methyl group is readily prepared. (auth)

2535

PREPARATION OF I^{131}-DIIODOFLUORESCEIN. J. Vigne and J. Fondarai. Bull. soc. chim. France, 331-2(1953) Mar. (In French)

A simple technique for preparing I^{131}-labeled diiodofluorescein from uranin is described. Experiments show that the fixed iodine in the fluorescein does not exchange with free iodine. (tr-auth)

URANIUM AND URANIUM COMPOUNDS

2536

ADDITIONAL FLUORITE PHASES IN THE MIXED RARE EARTH–URANIUM OXIDES. INVESTIGATIONS OF THE SYSTEMS OF La_2O_3, Nd_2O_3, Sm_2O_3, Yb_2O_3, AND Sc_2O_3 WITH U_3O_8. F. Hund and U. Peetz. Z. anorg. u. allgem. Chem. 271, 6-16(1952) Dec. (In German)

In the La_2O_3-U_3O_8 system, a fluorite phase occurs from 33 to 70 mole % La_2O_3; the lattice constant increases from 5.462 to 5.543 kX for the mixed crystal containing 68.0 mole % La_2O_3. On the La_2O_3-rich side of this appears the C type of the sesquioxide, which is stable throughout the anomalous mixed crystal formation up to 1200°C. The fluorite mixed crystals have intact cation lattices. In the Nd_2O_3-U_3O_8 systems, anomalous mixed crystals of the fluorite type occur from 25 to 65 mole % Nd_2O_3; in the corresponding concentration range, the lattice constant varies from 5.423 to 5.437 kX. At higher Nd_2O_3 contents the C-type structure appears and is stable up to 1200°C. The anomalous fluorite mixed crystals also have intact cation lattices. Fluorite phases have also been observed in the systems of U_3O_8 with Sm_2O_3, Yb_2O_3, and Sc_2O_3; the lattice constants for the 50 mole % mixed crystals have been determined. The individual systems studied so far are compared with one another, regularities are considered, and the relation of the color to composition and preparation temperature is described. (tr-auth)

2537

OXIDATION OF UO_2 AT LOW TEMPERATURE. P. Pério. Bull. soc. chim. France, 256-63(1953) Mar. (In French)

Oxidation of $UO_{2.10}$ and $UO_{2.40}$ in air at 120°C has been studied. In the initial stages, the fixation of O, followed by weight changes, partially occurs in a way not detectable by oxidimetry, and the crystallographic parameters do not change. As the quantity of fixed O increases, a tetragonal α phase of essentially constant parameters (a = 5.436, c/a = 0.991) and of U content slightly above $UO_{2.32}$ appears. This oxide is distinct from the tetragonal γ phase previously described. Contrary to previous reports (NSA 6-3773), the composition of the latter, $UO_{2.40}$, is fixed for temperatures below 400°C. The parameters are a = 5.364 and c/a = 1.031. The cubic α phase previously reported (NSA 6-3773) is metastable with respect to UO_2 + U_4O_9; the latter oxide constitutes, above 700°C, the limit of the homogeneous domain that extends toward low U contents, reaching $UO_{2.21}$ at 1000°C. (tr-auth)

2538

URANIUM OXYSULFIDE. Marius Picon and Jean Flahaut. Compt. rend. 236, 816-18(1953) Feb. 23. (In French)

Chemical properties of UOS, prepared by heating U_3O_8 in H_2S, are reported. It is practically insoluble in cold acids, except HNO_3, is easily oxidized, and reacts with carbon above 1350°C to give US. (G.Y.)

2539

A NEW OXYBROMIDE OF PENTAVALENT URANIUM. Jacques Prigent. Compt. rend. 236, 710-11(1953) Feb. 16. (In French)

A method for brominating UO_3 to produce $UOBr_3$ is described. On being heated, this compound readily loses Br and is transformed into $UOBr_2$, which has previously been prepared but by a much more complicated method. (tr-auth)

2540

URANIUM(IV) BOROHYDRIDE. H. I. Schlesinger and Herbert C. Brown. J. Am. Chem. Soc. 75, 219-21(1953) Jan. 5.

U(IV) borohydride was prepared by the reaction of U(IV) fluoride with excess Al borohydride, $UF_4 + 2Al(BH_4)_3 \rightarrow U(BH_4)_4 + 2AlF_2(BH_4)$. Its green crystals are volatile at room temperature. Its relatively low molecular weight and the volatility give it special interest. Reactions with H_2O, methanol, and HCl were observed. At room temperature the borohydride, when sealed in evacuated glass containers, may be kept for long periods of time with only very slight decomposition; the rate of decomposition remains small up to about 70° in the absence of catalysts. At 100° it decomposes at a moderate rate to give U(III) borohydride, a reddish-brown solid, as shown by the equation: $U(BH_4)_4 \xrightarrow{100°} U(BH_4)_3 + \frac{1}{2}H_2 + \frac{1}{2}B_2H_6$. At 150 to 200° U(IV) borohydride undergoes decomposition to give a mirror of silvery metallic appearance. The reaction is: $U(BH_4)_4 \rightarrow UB_4$ (or $U + 4B$) $+ 8H_2$. U(IV) borohydride is fairly stable to dry air; U(III) borohydride is pyrophoric. (auth

2541

THE METHYL DERIVATIVES OF URANIUM(IV) BOROHYDRIDE. H. I. Schlesinger, Herbert C. Brown, L. Horvitz, A. C. Bond, L. D. Tuck, and A. O. Walker. J. Am. Chem. Soc. 75, 222-4(1953) Jan. 5.

Treatment of $U(BH_4)_4$ with trimethylboron at 50 to 70° results in the formation of methylated derivatives. Two products, a monomethyl and a tetramethyl derivative of $U(BH_4)_4$ have been isolated. On the basis of their reactions with H_2O and HCl the structures $U(BH_4)_3(BH_3CH_3)$ and $U(BH_3CH_3)_4$ have been assigned. The monomethyl derivative is more volatile than the parent compound and is the most volatile known derivative of tetravalent U. $U(BH_4)_4$ is alkylated also by triethylboron and higher alkyl borons. However, pure compounds were not isolated from the reaction products. (auth)

ENGINEERING

AEROSOLS

2542

Air Cleaning Lab., Harvard Univ. School of Public Health

AIR CLEANING STUDIES; PROGRESS REPORT FOR FEBRUARY 1, 1951 TO JUNE 30, 1952. Melvin W. First, Leslie Silverman, Richard Dennis, August T. Rossano, Charles Billings, Edward Conners, Ralph Moschella, Edward Berly, Sheldon Friedlander, and Philip Drinker. Dec. 16, 1952. 132p. (NYO-1586)

Progress of the work is reported on methods of collection and evaluation of gas samples, evaluation of commercial dust collector performance, research and development of air cleaning methods and equipment, and consulting and training services to the AEC. (J.E.D.)

HEAT TRANSFER AND FLUID FLOW

2543

Carbide and Carbon Chemicals Co. (K-25)

MOMENTUM TRANSFER AND MOLECULAR TRANSPORT. W. H. Eberhardt. Issued Mar. 12, 1953. 36p. (K-992)

A detailed study of momentum loss in a long channel of arbitrary cross section demonstrates that the discrepancy between momentum-loss and molecular path-tracing calculations of transport in the Knudsen flow regime is to be attributed to improper averaging of velocities in the momentum-loss calculation and to geometrical factors arising from the different dependence of momentum loss and molecular transport on the angle of the molecular path with the wall. The two methods agree in detail only for a right cylindrical capillary of infinite length. A novel abstraction of the effective density distribution in a right cylindrical capillary of finite length provides a straight-forward method for the calculation of the transport and momentum loss which satisfies requirements of internal consistency. These calculations confirm Clausing's results for the transport but indicate the inherent differences in momentum-loss and molecular path-tracing methods and point to the need of a more exact kinetic calculation of pressure. The assumption of an anomalous velocity distribution of molecules leaving the wall leads to rather unexpected results for the dependence of the transport on mean velocity and geometrical factors. For an infinitely long capillary the transport increases linearly with $\bar{v}$ over a reasonable range, for capillaries with $L = 4r$, it is independent of $\bar{v}$, for shorter capillaries it decreases with increasing $\bar{v}$. A physical mechanism for these results is suggested. (auth)

2544

Livermore Research Lab., Calif. Research and Development Co.

GRAPHICAL SOLUTIONS OF THE NON-BOILING AND SURFACE BOILING HEAT TRANSFER EQUATIONS. D. F. Casey. Jan. 12, 1953. 14p. (MTA-10)

The data presented are graphical solutions of the equations recommended by McAdams describing the two phases of forced-convection heat transfer to water, non-boiling and surface boiling. The solutions were obtained for ranges of variables to cover the majority of problems that arise in practice. (auth)

2545

Lewis Flight Propulsion Lab., NACA

ANALYSIS OF FULLY DEVELOPED TURBULENT HEAT TRANSFER AT LOW PECLET NUMBERS IN SMOOTH TUBES WITH APPLICATION TO LIQUID METALS. Robert G. Deissler. Aug. 11, 1952. 20p. (NACA-RM-E52F05)

An analysis was made of heat transfer at low Peclet numbers for fluids flowing turbulently in smooth tubes. Previous analyses for flow of gases and liquid metals at low Peclet numbers gave higher heat-transfer coefficients than were indicated experimentally. When the mixing-length theory was modified in order to account for the heat transferred by conduction to a turbulent particle as it moves transversely, the predicted results were brought into agreement with the experimental results. (auth)

2546

Lewis Flight Propulsion Lab., NACA

FORCED-CONVECTION HEAT-TRANSFER CHARACTERISTICS OF MOLTEN SODIUM HYDROXIDE. Milton D. Grele and Louis Gedeon. Feb. 17, 1953. 27p. (NACA-RM-E52L09)

An investigation of the forced-convection heat-transfer characteristics of NaOH was made for a range of Reynolds numbers from 5300 to 30,000, corresponding to velocities from 3.8 to 15.4 fps, average fluid temperatures up to 938°F, and heat-flux densities up to 226,000 Btu/hr/ft^2 for both heating and cooling. Water heat-transfer tests were also made to check the instrumentation. In addition, some heat-transfer tests were made with an aqueous solution of NaOH. When the NaOH heating data are correlated by the familiar Nusselt relation, the data fall slightly above the McAdams correlation line. The NaOH cooling data are fairly well represented by the McAdams correlation line. (auth)

2547

California Inst. of Tech.

ON THE DEVELOPMENT OF TURBULENT WAKES FROM VORTEX STREETS. Anatol Roshko. Mar. 1953. 77p. (NACA-TN-2913)

Wake development behind circular cylinders at Reynolds numbers from 40 to 10,000 was investigated by hot-wire techniques in a low-speed wind tunnel. The Reynolds number range of periodic vortex shedding is divided into two distinct subranges. In the stable range, R = 40 to 150, regular vortex streets are formed and no turbulent motion develops, the vortices decaying by viscous diffusion. The range R = 150 to 300 is a transition region to the irregular range in which turbulent velocity fluctuations accompany the periodic formation of vortices. The diffusion is turbulent and the wake becomes fully turbulent in 40 to 50 diameters. The turbulence is initiated by laminar-turbulent transition in the free layers which spring from the separation points on the cylinder. An annular vortex street was observed in the wake of a ring. (NACA)

2548

Institute of Engineering Research, Univ. of Calif., Berkeley
FLOW METERING OF MOLTEN LEAD-BISMUTH EUTECTIC AT UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA. R. A. Seban, W. T. Schrank, and D. Bartz. Apr. 25, 1949. 11p. (NP-4452)

MATERIALS TESTING

2549

Hydrocarbon Research, Inc.
TECHNIQUES AND MATERIALS FOR USE AT LIQUID HYDROGEN TEMPERATURES. INFORMATION SECURED AT OHIO STATE UNIVERSITY, MARCH 7-9, 1950. M. Benedict and P. Graff. Apr. 11, 1950. 49p. (N-2563d)

Thermodynamic properties of H, solid-vapor equilibrium in N-H mixtures, adsorption of N and O from H, rate of conversion of ortho to para H, and the explosion of solid O in liquid H are discussed. Data are presented on the thermal conductivities of insulating materials, plastics, metals, and alloys measured at temperatures from liquid H up, and at pressures from high vacuum to atmospheric with H, He, or N gas atmosphere between insulation particles. Data on physical properties at low temperatures of metals and alloys used as materials of construction, and methods of measurement of thermal conductivity at liquid H temperatures are included. (C.H.)

PUMPS

2550

Battelle Memorial Inst.
THE INERTIA PUMP. R. W. Dayton, E. M. Simons, and W. H. Goldthwaite. Dec. 18, 1952. 42p. (BMI-795)

A sealless, bearingless pump has been devised in which a variable fluid pressure is developed by the inertia of the fluid in an oscillating helix of tubing. The ends of the helix are connected by radial tubing to flexible connections at the center of oscillation. The theoretical analysis reveals that wide ranges of pressures and deliveries are possible. Head-capacity measurements on an experimental model have shown pressure values consistently higher than those predicted by theory. These deviations can probably be attributed to deviations of the motion of the model from the sinusoidal motion assumed in the theory. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

2551

Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. F. H. Norton, W. D. Kingery, G. Economos, and M. Humenik, Jr. Feb. 1, 1953. 74p. (NYO-3144)

Fundamentals involved in cermet fabrication and properties are considered. These include metal-ceramic reactions, surface and interfacial energies, constituent properties, and the effect of the disperse state on the properties. These factors will affect metal-ceramic bonding, body composition, and phase distribution which are important in fabrication and properties. Strength, oxidation resistance, thermal conductivity, and thermal shock resistance are considered. Interfacial reactions of various metals (Be, Mo, Nb, Ni, Si, Ti, Zr) with dense oxide specimens (Al_2O_3, BeO, MgO, ThO_2, TiO_2) were studied at temperatures up to 1800°C. Reactions in general occur in the same order as thermodynamic stabilities indicate. Four general types of reactions were observed. Little or no reaction occurred at 1400°C, but considerable reaction took place in many systems at 1800°C. The wettability and adherence of metal-ceramic systems were studied, using a precise sessile drop method. The surface tension and wettability of Si, Fe, and Ni in contact with various refractory materials were evaluated at elevated temperatures. Measurements were carried out in vacuo, H, and He. Generally, non-wetting contact angles were observed for Fe and Ni with oxides, while Si was found to partially wet the oxides. In all cases the wettability was greater for the metal-graphite and Be_2C systems than for the metal-oxide systems. The nature of the atmosphere was found to have a significant effect on the wettability and surface tension of the metal. Wettability results are interpreted on the basis of surface tension and by the consideration of free-energy changes. By means of equilibrium interfacial-angle measurements the surface and interfacial energies in the systems Ni-Al_2O_3 and Ni-ZrO_2 were determined at elevated temperatures. Coincidental measurements of surface tension and contact angle for Fe and Fe-Si alloys in Al_2O_3 give values of interfacial energy. Application of Gibbs' isotherm indicates that interfacial adsorption of Si takes place in this system. (auth)

2552

Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. F. H. Norton, W. D. Kingery, M. C. McQuarrie, M. Adams, A. L. Loeb, and J. Francl. Mar 15, 1953. 98p. (NYO-3643)

The several sections of this report are each topical summaries of research on thermal conductivity of refractory materials. These investigations include a consideration of factors affecting thermal conductivity and principles of measurement, the development of a relationship for the heat flow in a prolate spheroid, experimental details and results for a prolate spheroid envelope method with resistance and induction heating, a spherical and cylindrical envelope method, and a linear flow comparative method. The agreement between these methods is good and results are reported for various dense oxide refractory materials. The effects of transmitted radiation at elevated temperatures and an empirical relationship between thermal conductivity and temperature of the refractory oxides have been determined. (auth)

CORROSION

2553

Naval Research Lab.
THE THERMAL PROPERTIES OF SODIUM HYDROXIDE AND LITHIUM METAL; FOURTH PROGRESS REPORT [FOR] NOVEMBER 1, 1952 TO JANUARY 31, 1953. R. R. Miller. Mar. 1953. 7p. (NRL-Memo-130; Progress Report No. 4)

Recent tests involving magnetic susceptibility measure-

ments have thrown new light on the mechanism of the NaOH-Ni reaction. The mechanism involves a reaction which lends itself to semi-reversal, and to nearly complete inhibition by the employment of a H atmosphere and controlled temperature gradients. Equilibrium pressures for the reaction are given for the 700 to 1100°C range. Conditions required for inhibition of mass transfer and reaction include a pressure of pure H in excess of the equilibrium pressure of the reaction, and elimination of excessive free or dead space in the system. A static system is preferable, also. Ni of high purity has been selected as a container material for physical property measurements on NaOH. [No work on Li is reported.] (auth)

GEOLOGY AND MINERALOGY

2554

[Los Alamos Scientific Lab.]

DRILLING ON ENIWETOK ATOLL, MARSHALL ISLANDS. H. S. Ladd, Earl Ingerson, R. C. Townsend, Martin Russell, and H. Kirk Stephenson. [nd] 49p., 5 illus. (AECU-2439)

Drilling on Eniwetok Atoll, Marshall Islands, revealed the presence of olivine basalt beneath shallow-water, Eocene limestone at a depth of 4154 ft. Two holes were put down on opposite sides of the atoll: F-1 on the northwest where a guyot (flat-topped seamount) adjoins the atoll at 700 fathoms, and E-1 on the southeast where no guyot is present. In F-1, hard basement rock was struck at 4610 ft, but no sample recovered. In hole E-1, unweathered basalt cuttings were obtained from a depth of 4154 ft and solid basalt core from 4208 to 4222 ft. Each hole penetrated several hundred ft of soft, Quaternary reef limestone before entering a thick, Tertiary section of similar rocks. The Tertiary sediments are mostly limestones with minor amounts of dolomite and dolomitic limestone. Some of the limestones are made up of clay-size and silt-size particles and are carbonaceous. Most of the section is soft or weakly consolidated. The two holes are similar to depths of 1400 ft; below this point there are striking differences in lithology, organic constitution, and the distribution of hard rock and cavities. The drilling data indicate that the atoll is a thick cap of limestone resting on the summit of a volcano that rises two miles above the floor of the ocean. (auth)

2555

Geological Survey

URANIUM DEPOSITS OF THE BULLOCH GROUP OF CLAIMS, KANE COUNTY, UTAH. E. P. Beroni, F. A. McKeown, F. Stugard, Jr., and G. B. Gott. [1953] 11p., 3 illus. (GS-C-239)

The Bulloch group of uranium claims is in T. 40 S., R. 9 W., Kane County, Utah. In June 1950, 8.5 tons of submarginal ore was shipped to the Marysvale purchasing depot of the Atomic Energy Commission; this shipment assayed 0.16% U_3O_8. U compounds are finely disseminated in clay, carbonized wood fragments, iron oxide concretion, petrified logs, sandstone, and conglomerate of the lower part of the Dakota sandstone and upper part of the Summerville formation. Small quantities of the U minerals carnotite, tyuyamunite, and autunite were recognized in the conglomerate and sandstone on Lynn Nos. 2 and 3 claims. Exposures of three uraniferous lenses, each less than 75 ft long, contain as much as 0.1% uranium. The presence of U in ground water and in plants indicates that the U is being redistributed by ground water and may suggest the presence of concealed ore deposits nearby. (auth)

2556

Department of Mines and Technical Surveys, Mines Branch, Ottawa (Canada)

THE EQUILIBRIUM COUNTER ASSEMBLY. G. G. Eichholz. Jan. 16, 1953. 17p. (NP-4414; TR-107/53)

The design and assembly of an equilibrium counter for the radiometric assaying of U and Th in ores is described. Detailed drawings of the detector assembly are provided and suitable commercial scaling equipment discussed. Some modifications in available equipment are suggested. (auth)

2557

Pennsylvania State Coll.

THE MEGASCOPIC AND FIELD EXAMINATION OF SAMPLES FROM THE SALT WASH SEDIMENTS IN SOUTHWEST COLORADO AND SOUTHEAST UTAH. John C. Griffiths. Issued Dec. 1952. 52p. (RME-3023)

This report is mainly concerned with the collection and preliminary treatment of samples, the assembling of personnel and equipment commenced in late September, and the formulation of a preliminary sampling program for Bull Canyon well 155 C. A section is also included on the impressions of the problem gained by examination of samples and from the field trip to southwestern Colorado and southeastern Utah in September. This is a preliminary discussion and the suggestions are tentative. Nevertheless it may prove fruitful in ventilating possibilities which can be critically examined in the field while the laboratory work is being compiled to check on the various impressions and hypotheses. (auth)

2558

Amherst Coll.

URANIUM IN THF DIRTY DEVIL SHINARUMP CHANNEL DEPOSIT. George W. Bain. Issued June 1952. (RMO-66)

A 12 kg specimen of Dirty Devil No. 6 deposit had 0.105% U in two hydrocarbons, jasperoid, clay, and water soluble components. Another bulk specimen averaged 0.069% U. Hydrocarbons comprise 0.75% of the rock with an average of 0.30% U or 0.002% of the deposit. Jasperoid comprises 38.5% of the rock, has an average of 0.089% U for a total U equivalent to 0.034% of the deposit. Clay and dissolved components comprise 20.5% of the rock, and carry most of the remaining U or equivalent to about 0.066% for the deposit. The low residue of U is in heavy minerals. The ores occur in a river channel deposit of composite type. About 42.5% is a normal gravel alluvium. This is diluted by 35% of dune sand which helped form pools and filtered out fines that make the remaining 22.5%. The fluviatile fraction is over 60% jasperoid pebbles and sand. The jasperoid pebbles, sand, and silt are the primary U carrier and represent detritus from a leptothermal U deposit of Permian age. The hydrocarbon is a relatively stable U accumulator; enrichment of its U content occurred during the times of active artesian circulation initiated by the Laramide Revolution, Oligocene age disturbances, and Pliocene warping of the Rocky Mountain peneplain. U and its daughter elements segregate during migration and each has its own accumulator. The entire deposit stays close to radioactive equilibrium but individual mineral components have departures up to 1000 fold. (auth)

2559

Geological Survey

RECONNAISSANCE OF THE CLINTON FORMATION IN NEW YORK, PENNSYLVANIA, MARYLAND, AND NEW JERSEY. R. W. Schnabel and Rollin C. Vickers. Jan. 1953. 12p. (TEM-434)

The Clinton formation and equivalents of Silurian age were tested radiometrically at 31 localities in N.Y., Penna., Md., and N.J. Particular attention was given to the phosphatic and hematitic parts of the formation. None of the places tested showed abnormal radioactivity. (auth)

METALS AND METALLURGY

2560

Bureau of Mines

HIGH-TEMPERATURE EXPERIMENTS WITH ZIRCONIUM

AND ZIRCONIUM COMPOUNDS. W. J. Kroll, W. R. Carmody, and A. W. Schlechten. Nov. 1952. 31p. (BM-RI-4915)

This report is concerned with the sidelines investigated incidental to the development of a process to produce ductile Zr. Data are presented on the following studies: zircon decomposition (chlorination of C-zircon mixtures, comparison of carbide and zircon chlorination processes, chlorination with chlorides, production of $ZrCl_4$ from K_2ZrF_6 and from ZrSi, reaction of zircon with S and with K_2SiF_6); direct production of Zr alloys (C reduction of ZrO_2 in the presence of metals, reduction of Zr halides with metallic reducing agents, Cu-Zr alloys by fusion electrolysis, various alternative methods); reaction of metals with $ZrCl_4$; Cl affinities; plating Zr alloys on other metals by chemical methods; smooth plating of pure Zr by electrolysis from a fused bath; fusibility of Zr-NaCl mixtures; production of Zr powder by fusion electrolysis; general chemistry of Zr; and O_2 determination in Zr by chlorination method. (L.T.W.)

2561

Notre Dame Univ.

SURVEY OF PORTIONS OF THE IRON-NICKEL-MOLYBDENUM AND COBALT-IRON-MOLBYDENUM TERNARY SYSTEMS AT 1200°C. Dilip K. Das and Paul A. Beck. Feb. 1953. 56p. (NACA-TN-2896)

The 1200°C isothermal sections of the Fe-Ni-Mo and the Co-Fe-Mo ternary systems were surveyed. The phases occurring in these systems were identified by means of x-ray diffraction and by etching methods, and the phase boundaries at 1200°C were determined microscopically, using the disappearing-phase method with quenched specimens. Both systems contain long solid-solution fields of the mu phase. Other intermediate phases occurring in the Fe-Ni-Mo system are the P phase and the delta phase. Both phase diagrams have extensive f.c.c. solid-solution fields and some b.c.c. solid solutions. (auth)

2562

Lewis Flight Propulsion Lab., NACA

EFFECT OF PROCESSING VARIABLES ON THE TRANSITION TEMPERATURE, STRENGTH, AND DUCTILITY OF HIGH-PURITY, SINTERED, WROUGHT MOLYBDENUM METAL. Kenneth C. Dike and Roger A. Long. Mar. 1953. 26p. (NACA-TN-2915)

High-purity, sintered, wrought Mo has a transition-temperature range near room temperature which varies according to the amount of swaging reduction; increasing swaging reduction decreases the transition-temperature range. Recrystallized metal possesses a higher transition-temperature range than as-swaged metal, regardless of the amount of prior working. Ultimate tensile strengths of as-swaged, stress-relieved, or recrystallized metal are affected by varying amounts of working from 35 to 99% swaging reduction, but the differential is not large. Ductility of as-swaged metal at room temperature increases with increased working; however, when stress-relieved, the ductility does not vary with working. Recrystallized metal has good ductility above the transition range provided that the prior working is greater than about 50%. Other data are presented as to grain size, type of fracture, and chemical analysis. (NACA)

2563

Metallurgical Advisory Committee on Titanium

PROCEEDINGS OF THE TITANIUM SYMPOSIUM AT WATERTOWN ARSENAL, WATERTOWN, MASSACHUSETTS [HELD ON] OCTOBER 8, 1952. [nd] 59p. (NP-4417; Inf. Bull. T5)

This symposium was devoted to a discussion of the properties, corrosion, machinability, metallurgy, availability, and development of Ti. Attention was directed to the aspects of the metal most useful to industry and commercial fields as well as to ordnance. (J.E.D.)

2564

Institute of Engineering Research, Univ. of Calif., Berkeley

EFFECT OF COPPER ADDITIONS ON THE PLASTIC PROPERTIES OF AN Al-Zn ALLOY. C. D. Starr and J. E. Dorn. Jan. 1, 1953. 12p. (NP-4422; Technical Report No. 23)

Investigation reveals that the stress-strain curves for ternary Al α solutions containing Zn and Cu are homologous with those for the binary Al alloys; the plastic properties of ternary Al α solid solutions do not obey a simple additive law; the concept of Cu-equivalents can be extended to ternary Al alloys and the Cu equivalent of Zn in a ternary Al alloy increases with the Cu content. (auth)

2565

Armour Research Foundation

SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS. INTERIM TECHNICAL REPORT NO. 3 [FOR] JUNE 1, 1952–NOVEMBER 30, 1952. R. W. Hanzel and V. Pulsifer. [nd] 45p. (NP-4435; WAL-401/84-20; Interim Technical Report No. 3)

Study is made of the surface hardening of Ti and its alloys by the addition of the metalloid elements O, N, C, B, and H. The treatment of the special Ti-base binary alloys in an atmosphere of purified N is reported. The N treatment of the Ti-base V and B alloys resulted in the most significant effect on the final surface hardness. Notched-bar impact testing of nitrided commercial Ti has been initiated. Preliminary results are included. A complete résumé of the process of electrolytic treatment of commercial Ti in molten borax is given. (J.E.D.)

2566

Lehigh Univ.

STRESS-RUPTURE AND CORROSION TESTS OF TYPE 347 STAINLESS STEEL IN MOLTEN EUTECTIC LEAD-BISMUTH ALLOY; FIRST ANNUAL REPORT FOR THE PERIOD JUNE 1, 1951 TO MAY 31, 1952. Francis H. Laxar. May 31, 1952. 10p. (NP-4439)

The determination of stress-rupture and corrosion properties of stainless steel when immersed in molten Bi-Pb alloy at temperatures of 800, 900 and 1000°F is presented together with a description of equipment and testing procedures. (J.E.D.)

2567

Massachusetts Inst. of Tech.

1. FUNDAMENTAL DEFORMATION CHARACTERISTICS OF 80 NICKEL-20 CHROMIUM ALLOY IN CREEP AT ELEVATED TEMPERATURES. 2. AGING IN NICKEL-CHROMIUM ALLOYS HARDENED WITH TITANIUM AND ALUMINUM. PERIODIC STATUS REPORT NO. 2 [FOR] NOVEMBER 1952–FEBRUARY 1953. H. C. Chang, R. Nordheim, and N. J. Grant. [nd] 8p. (NP-4442; Periodic Status Report No. 2)

An 80% Ni-20% Cr alloy was subjected to creep at 1150°F and loading stress ~20,000 psi. The alloy elongated 4.2%, and two types of deformation patterns were noted in the twins caused by slip in the grains. In one type of deformation the twins are fairly wide, and the slip bands are sharply bent and continuous in going across the twin boundaries. The slip bands appear regular and straight in the twins. In the second type of deformation the twins narrowed down in going from the top to the bottom of the same grain. The heavy slip bands in the grain disappear suddenly at the twin boundaries. The heavy slip bands at both sides of the twin are connected by faint markings in the twins. Two types of precipitate occurred in Ni-Cr alloys hardened with Ti and Al, dependent on the amounts of Ti and Al present. When only Al was added, a very fine precipitate of spheroidal shape was formed during

the aging treatment. More than 70% of the Al atoms could be replaced by Ti without changing the appearance of the precipitate. When only Ti was added, a needle-shaped constituent precipitated during aging. (See NP-4214 for preceding quarter) (L.T.W.)

2568

General Electric Research Lab.

FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; SIXTEENTH QUARTERLY REPORT (PROGRESS REPORT NO. 33). J. H. Hollomon and D. Turnbull. Jan. 5, 1953. 9p. (SO-2026; RL-819; Progress Report No. 33)

Studies on self-diffusion of Ag in Ag-6.6% Cu show a marked increase in the magnitude of the diffusion coefficient, but little change in the activation energy. Self-diffusion studies of Ag indicate that the 2 grains forming the boundary have (100) poles parallel to the direction of diffusion. Data for self-diffusion of Ag bicrystals for $\theta = 28°$ and $\theta = 30°$ fall reasonably well on the straight line given by the equation $D_B = 3.6\ \exp(-25{,}000/RT)\text{cm}^2\text{sec}^{-1}$. The magnitude of the grain-boundary self-diffusion coefficients for $\theta = 41°$ is larger than the values given by the equation by a factor of 3 to 4. The activity of Fe in solid Fe-Ni alloys at 842°C is given with respect to supercooled γ iron. Measurements were completed on galvanic emf developed between pure Cu and each of six Cu-Au alloys. (L.T.W.)

2569

Bureau of Mines

UNITED STATES BUREAU OF MINES ZIRCONIUM ALLOY INVESTIGATION. E. T. Hayes, R. L. Carpenter, A. D. Cavett, H. Kato, W. L. O'Brien, and O. G. Paasche. Nov. 1952. 32p. (WADC-TR-52-236)

The purpose of this program was to prepare and evaluate zirconium alloys with respect to corrosion resistance and mechanical properties at room temperature. An outline of phase diagrams was made for workable alloys, based on heat-treatment, x-ray analysis, resistivity, thermal analysis, metallographic structures and other metallurgical studies. The salient features are presented for the alloy systems Zr-Ti, Zr-Cr, Zr-Ni, and Zr-Mn. The method of preparation of these alloys is outlined. Melting of zirconium sponge and alloy additions by the use of graphite molds in a graphite resistor furnace has been largely replaced by arc melting in an inert atmosphere using water cooled copper molds. Contamination of the melt by carbon is considerably reduced by this process. Increased ductility, and corrosion and heat resistance, but decreased tensile strength results from this change of melting procedure. The fabrication is accomplished by hot rolling to sheet the metal sealed in an iron pipe. Improved homogeneity is obtained by heat treatment. (auth)

2570

Massachusetts Inst. of Tech.

TITANIUM RICH TITANIUM-CHROMIUM-OXYGEN TERNARY SYSTEM. Chih-Chung Wang, Nicholas J. Grant, and Carl F. Floe. Nov. 1952. 27p. (WADC-TR-52-255)

The existence of a ternary phase, Ti_3Cr_3O, has been confirmed. It has a f.c.c. structure with a lattice constant of 13.80 Kx. This phase does not form directly from the liquid phase. The temperature range in which Ti_3Cr_3O is stable has not been determined, but it is possible that it may transform to α or other phases at higher temperatures. (auth)

2571

Watertown Arsenal Lab.

ELECTROPLATING ON TITANIUM; FIRST PROGRESS REPORT. Charles Levy. July 8, 1952. 24p. (WAL-401/146; Progress Report No. 1)

Problems involved in plating on Ti and Ti alloys are reviewed. Results of tests on 85 samples of Ti and Ti alloys using various plating solutions, pre-treatment, and plating conditions, are presented and discussed. (C.H.)

2572

FACTORS WHICH DETERMINE THE PERFORMANCE OF ALUMINUM ALLOY WELDMENTS. W. R. Apblett, Jr., C. R. Felmley, and W. S. Pellini. Welding J. 31, 596S-606S(1952) Dec.

The explosion bulge test was utilized to establish the factors which determine the performance of Al-alloy weldments. Two types of alloys were investigated: (1) the common heat-treatable type alloys (61S and 24S) and (2) the solid-solution hardening type containing Mg as the primary alloying element. The deformation characteristics of the various weld and base-metal combinations were determined by means of photogrids applied to the surface of the specimens. Tensile test data of the weld joints and parent plate were alos obtained in order to establish the significance of the deformation characteristics. It is indicated that the inability of weldments of heat-treatable type alloys to develop appreciable deformation is due to strain concentration in the low-strength weld and heat-affected zone. Weldments of the solid-solution hardening type alloys are capable of developing extensive deformation prior to failure due to a more desirable distribution of strain in the weld, heat-affected zone, and parent metal. This is the result of a closer matching of the strengths and ductilities of the various components of the weldment which is possible by the use of these alloys. (auth)

2573

THE CONTROL OF QUALITY IN MELTING AND CASTING MAGNESIUM ALLOYS FOR HOT WORKING. R. G. Wilkinson and S. B. Hirst. J. Inst. Metals, 20, 393-400(1953) Mar.

A description is given of present practices in the control of quality and inspection in the melting and casting of the three principal types of Mg alloy used for wrought purposes, viz. Mg-Mn, Mg-Al-Zn-Mn, and Mg-Zr-Zn. The Zr-containing alloys are considered separately, not only because special procedures are involved in their melting, but also because they are always cast by the semi-continuous direct-chill process. Except on a laboratory scale, rolling, extrusion, and forging are not carried out in the authors' works, and thus the use of commercial-scale hot working as a running routine "inspection" method is not possible. The inspection processes applied before the cast stock is sent out to other works are therefore crucial. (auth)

2574

EFFECTS OF CARBON, OXYGEN AND NITROGEN ON WELDS IN TITANIUM. D. C. Martin. Welding J. 32, 139S-54S(1953) Mar.

An investigation of the effects of C, O, and N on the strength and ductility of Ti welds was carried out after making inert-gas-shielded W-arc and spot welds in Ti-C, Ti-O, and Ti-N sheets of various thicknesses. Results show that C, O, and N can cause brittleness in welds when present in sufficient amounts. C should be kept below 0.28%, O below 0.15%, and N below about 0.05% to avoid brittle welds. (L.M.T.)

PHYSICS

2575

Los Alamos Scientific Lab.

PERMEABILITY AND SOLUBILITY OF He^3 AND He^4 IN VITREOUS SILICA. W. M. Jones. [nd] 14p. (AECU-2433; LADC-1331)

The relative permeabilities and solubilities of He^3 and He^4 in vitreous silica have been measured as a function of

temperature, and the differences in the diffusion activation energies and heats of solution evaluated. The absolute permeabilities and solubilities were also obtained. (auth)

2576

Research Lab. of Electronics, Mass. Inst. of Tech.
A BIBLIOGRAPHY OF INFORMATION THEORY (COMMUNICATION THEORY — CYBERNETICS). F. L. Stumpers. Feb. 2, 1953. 48p. (NP-4444)

In this third edition of the bibliography new groups have been made for several subjects, namely: (1) signal-to-noise ratios, comparison of systems, (2) linguistics and semantics, (3) human engineering, (4) group communication and learning, and (5) optics. (L.M.T.)

2577

Radiation Lab., Univ. of Calif., Berkeley
CAUSES OF FAILURE OF VACUUM SYSTEMS. W. E. Bush. Issued July 15, 1952. 5p. (UCRL-1887)

It is harder to analyze troubles when a vacuum system is operating slightly below normal than in case of total failure. For that reason a key is presented as an aid to the uninitiated in locating the cause of failure in a poorly operating system. It is based upon the assumption that a system is operable or has been satisfactorily operated, thus no design deficiencies are incorporated in such an attempted analysis. (L.M.T.)

2578

Radiation Lab., Univ. of Calif., Berkeley
PHYSICS DIVISION QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, AND OCTOBER 1952. Dec. 16, 1952. 36p. (UCRL-2054)

An experiment to determine the production of positive and negative pions by neutrons in O is briefly described. The plus/minus production ratio of ~15 Mev mesons from α-particle bombardment of C was found to be 0.72 ± 0.17, providing support for the charge-symmetry hypothesis. Frequency distributions of protons and deuterons scattered from C at 24° to the beam are shown. An experimental survey of charged mesons produced by a 290-Mev neutron beam on Be and C was completed. The photoproduction of negative pions from D is reported. The differential cross sections for the reaction $p + d \rightarrow t + \pi^+$ for various triton c.m. angles were measured. Work was continued on measurement of the yield of pions at 180° by 340-Mev protons on C. Operation and development of the 60-in. cyclotron are reported. (See UCRL-1948 for preceding quarter.) (L.T.W.)

2579

Radiation Lab., Univ. of Calif., Berkeley
EMPIRICAL CONSIDERATIONS OF ENTROPY. II. THE ENTROPIES OF INORGANIC COMPLEX IONS. James W. Cobble. Feb. 3, 1953. 17p. (UCRL-2104)

A method is proposed by which the partial molal entropies of aqueous complex ions can be correlated in a simple manner as a function of the ratio of their charge to interatomic distance. The agreement obtained between the observed values and those calculated by this method has been shown to be within the accuracy of the experimental data. It is also demonstrated that when the complexing agent is water alone (i.e., no complexing) the proposed equation reduces to an expression similar to that previously obtained by Powell and Latimer for simple monatomic ions. (auth)

2580

FLUORESCENSE — PROPERTIES, APPLICATIONS. Marguerite Héros and René Héros. Translated by C. A. Horton from Ann. chim. anal. 24, 118-21, 137-9(1942). 15p. (AEC-TR-2010)

2581

THE RECOVERY AND PURIFICATION OF TRITIUM AND He^3 USED IN ION ACCELERATORS. K. W. Allen and E. Almqvist. Rev. Sci. Instruments 24, 70-1(1953) Jan.

The technique for recovery and purification of H^3 and He^3 used in the ion source of the 200-kv H.T. set at Chalk River is described. A differential pumping system separate from the main pumps which evacuate the accelerating tube is used. The H^3 is stored by absorbing it on spongy U in a stainless steel vessel from which it can be re-evolved in a purified form at any desired pressure by controlled heating. The He^3 is purified by passing it through activated charcoal at liquid air temp. and is stored as a gas. The complete arrangement of the differential pumping and recovery system is shown. (L.M.T.)

2582

THE ENTROPY OF LIQUID He^3. Tien Chi Chen and F. London. Phys. Rev. 89, 1038-40(1953) Mar. 1.

The vapor pressure of liquid He^3, as measured by Abraham, Osborne, and Weinstock, is found to fit the following equation:

$$\log_{10}(P_{mm}/T^{3/2}) = 2.3126 - 1.1561/T - 0.25254T - 0.00667T^2 + 0.05266T^3 - 0.01210T^4,$$

up to 2.5°K. The entropy curve of the liquid derived from this equation goes smoothly to zero at 0°K, and in fact lies very close to the theoretical curve for a Fermi-Dirac smoothed potential liquid below 1°K. Hence the vapor-pressure data furnish no evidence for the existence of a transition below 1°K. (auth)

2583

VAPOR-LIQUID EQUILIBRIA IN He^3-He^4 SOLUTIONS. J. C. Morrow. Phys. Rev. 89, 1034-40(1953) Mar. 1.

Recent measurements of the vapor pressures of He^3–He^4 liquid solutions by Daunt and Heer and by Sommers are used to evaluate the solution non-ideality, for the calculation of which the large deviations of the vapor from ideality are taken into account. Estimation of the standard chemical potential of normal He^4 at temperatures below the λ point is discussed. Agreement of excess chemical potentials of He^4 above the λ point and the values obtained from the simple theory demonstrates the usefulness of the theory in discussions of effect of nonideality on the shift of the λ point with He^3 concentration. (auth)

COSMIC RADIATION

2584

APPARENT ABSENCE OF LOW-ENERGY PRIMARY COSMIC RADIATION. E. G. Dymond. Nature 170, 1078(1952) Dec. 20.

The lower energy limit of primary protons, as established by various published investigations, is discussed briefly. Uncertainties in calculation of the geomagnetic latitude from the geographical position and in secular variation of the geomagnetic field affect the interpretation of cosmic-ray data on energy limits. (G.Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2585

Indiana Univ.
THE CRYSTAL STRUCTURE OF ZINC 8-HYDROXYQUINOLINATE DIHYDRATE. Lynne L. Merritt, Jr., Richard T. Cady, and Belvey W. Mundy. [nd] 25p. (NP-4419)

The crystal structure of Zn 8-hydroxyquinolinate dihydrat $Zn(C_9H_6OH)_2 \cdot 2H_2O$, was determined by single-crystal methods. The unit cell is monoclinic with a = 11.28 A, b = 5.42 A, c = 13.16 A, and $\beta = 106°18'$. There are two molecules per unit cell. Atomic positions were determined by Fourier projections and were refined by a three-dimensions Fourier electron-density synthesis and by the method of least squares. Structure factors were obtained from visuall

estimated intensities on Weissenberg photographs taken with Cu Kα radiation. The molecule, with the exception of the water molecules, is essentially planar. Including the water molecules, there is a sort of distorted octahedral arrangement of bonds around the central Zn ion. The Zn-O and Zn-N bond lengths are 2.05 A and 2.06 A, respectively, while the Zn-OH_2 bond length is 2.27 A. (auth)

2586

Indiana Univ.

X-RAY STRUCTURE DETERMINATIONS OF SOME COMPOUNDS OF INTEREST IN ANALYTICAL CHEMISTRY. Lynne L. Merritt, Jr. [nd] 10p. (NP-4421)

A review of the structures of analytically important chelate complexes and chelating molecules which have been determined by x-ray-diffraction methods is given. It is suggested that precise structure determinations be made on both the chelating molecule and the complex so that intelligent appraisal can be made of the effect of structure on the formation of specific analytical reagents. With the aid of other data, such as force constants, some of the energetic factors in the formation of chelate complexes might be evaluated. (auth)

ELECTRONS

2587

ELECTROSTATIC LENSES PERMITTING FOCUSING OF PARTICLES OF HIGH ENERGY; CALCULATION OF TRAJECTORIES. Michel Yves Bernard. Compt. rend. 236, 902-4(1953) Mar. 2. (In French)

Equations are presented for the calculation of an ion trajectory in recently developed strongly convergent lenses for focusing high-energy particles. Study of the field distribution in the lens previously designed by the author (NSA 7-2025) shows that the convergence obtained is higher than with other types of electrostatic lenses. (tr-auth)

GASES

2588

Radiation Lab. Univ. of Calif., Berkeley

SUMMARY OF RESEARCH PROGRESS MEETING OF NOVEMBER 6, 1952, Sergey Shewchuck. Dec. 24, 1952. 5p. (UCRL-2068)

Stable Gas Molecules at Star Temperatures. L. Brewer. When Be and H_2O were heated to high temperatures in the Daniel's reactor, the Be disappeared, contrary to calculations. $Be(OH)_2$ (gas) was found to be very stable at 2000°K, the stability increasing with temperature. At 1800 to 1900°K the reaction $3Cu(s) + 3HCl(g) \rightarrow Cu_3Cl_3 + \frac{3}{2} H_2$ was observed. The oxides UO_3, MoO_3, and P_4O_{10} appear to be stable as gaseous molecules. At 2000 to 2500°K the reaction $Pt(s) + O_2(g) \rightarrow PtO_2(g)$ is observed. High-temperature studies of gaseous hydroxides revealed the existence of the molecules $Be{\cdot}H_2O$, $WO_3{\cdot}H_2O$, $SiO_2{\cdot}HO$, $MoO_3{\cdot}HO$, and FeOH. (L.T.W.)

2589

TRANSPORT PHENOMENA IN A COMPLETELY IONIZED GAS. Lyman Spitzer, Jr., and Richard Härm. Phys. Rev. 89, 977-81(1953) Mar. 1.

The coefficients of electrical and thermal conductivity have been computed for completely ionized gases with a wide variety of mean ionic charges. The effect of mutual electron encounters is considered as a problem of diffusion in velocity space, taking into account a term which previously had been neglected. The appropriate integro-differential equations are then solved numerically. The resultant conductivities are very close to the less extensive results obtained with the higher approximations on the Chapman-Cowling method, provided the Debye shielding distance is used as the cutoff in summing the effects of two-body encounters. (auth)

INSTRUMENTS

2590

Research Lab. of Electronics, Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT [FOR PERIOD ENDING NOVEMBER 30, 1952]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Jan. 15, 1953. 67p. (NP-4374)

Physical electronics research includes: measurements on the photoelectric emission from quartz; studies in the crystallographic variation of electron field emission from W; conduction mechanism in oxide-coated cathodes; temperature gradients across the Ag-AgCl-Ag system; and a control circuit for Bayard-Alpert-type ion gage. Microwave gaseous discharge studies include: probe studies of H in a cubical quartz bottle; oscillation studies in the range 500 to 2500 Mc with a new low-pressure Hg discharge tube; and electron-ion recombination in H_2. Measurements of the viscosity and second-sound pulse amplitudes in liquid He are reported. The following are reported under microwave spectroscopy: resolution of the 26,880-Mc HDO line; generation of harmonics in the mm region; and design studies for a new magnet for paramagnetic resonance research. Molecular beam research studies include proposed precision magnetic resonance experiment on Cs^{133} and hyperfine structure separations of the $3P_{3/2}$ state of Na. The deuteron-proton magnetic moment ratio in H gas was measured after improving the field homogeneity of the barrel-shaped electromagnet. Various communication systems and analog computer research activities are reported and a microwave transmission system was investigated. (See NP-4225 for previous period.) (L.M.T.)

2591

Colorado Univ.

ENERGY DISTRIBUTION IN LUMINESCENCE SPECTRA OF ORGANIC COMPOUNDS. PROGRESS REPORT [FOR] SEPTEMBER 1, 1952 TO JANUARY 31, 1953. Frank E. E. Germann. [nd] 11p. (NP-4451)

Installation of an infrared spectrometer is described. No experimental data are included. (C.H.)

2592

New York Operations Office, AEC

A TEST CIRCUIT FOR PULSE ION CHAMBERS. M. Edward Cassidy. Dec. 29, 1952. 14p. (NYO-4509)

A description of the circuit of a simple compact instrument for testing fast pulse ionization chambers is given; including instructions for its use in checking breath radon counting equipment NYOO Type B-2-1. (auth)

2593

A BAROMETER ELEMENT FOR RADIO-SONDES. H. V. Neher. Rev. Sci. Instruments 24, 97-8(1953) Feb.

The barometer unit described herein has proven to be extremely reliable when used on balloon flights to high altitudes. It consists of an aneroid element which moves an arm, making a series of contacts with no mechanical amplification involved. Working on the digital principle it gives its information when certain definite pressures have been reached. (auth)

2594

A SIMPLE PULSE-AMPLITUDE ANALYZER FOR LOW COUNTING RATES. K. Kandiah. Nucleonics 11, No. 3, 24-7(1953) Mar.

A description is given of an electromechanical system with a self-balancing potentiometric recorder which has been modified for 20-channel analysis. A circuit diagram is given and the waveforms at various points in the analyzer are shown. The instrument has been designed to accept pulses from 0.5 to 10 volts. The curves obtained in a typical run with a Po source, the calibration pulse, and on background are shown. (L.M.T.)

2595
PROCEDURE ASSURING THE STABILITY AND EQUALITY OF BAND WIDTHS IN A PULSE-AMPLITUDE SELECTOR. H. Guillon. J. phys. radium 14, 128-9(1953) Feb. (In French)

In the pulse-amplitude selector constructed by Wilkinson (NSA 4-5466), a condenser is charged at the maximum amplitude of the incoming pulse, then is discharged as a linear function of time. During the discharge the cycles of an oscillator of fixed frequency are counted to give a measure of the pulse amplitude. To this procedure has been added the principle of determining successively the band widths by the same mechanism, which automatically ensures their equality. (G.Y.)

2596
MAGNETIC WEIGHING AND GAS-DENSITY BALANCES. J. H. Simons, C. L. Scheirer, Jr., and H. L. Ritter. Rev. Sci. Instruments 24, 36-42(1953) Jan.

A design is given for an electromagnetic device that can be employed instead of weights or springs for weighing purposes. In this particular design the balancing current is linear with the force applied to the arm of the balance so that current measurement gives a direct reading of weight. A capacity null-point indicator automatically operates the electromagnet. The auxiliaries are shown incorporated in a density balance sensitive to a change of weight of better than 10^{-7} g or, in terms of oxygen pressure at room temperature, to 0.02 mm of Hg. The designs of density balances are discussed. (auth)

ISOTOPES

2597
Oak Ridge National Lab.
ELECTROMAGNETICALLY ENRICHED ISOTOPES; INVENTORY, JANUARY 31, 1953. C. P. Keim, C. E. Normand, and Boyd Weaver. Issued Mar. 17, 1953. 41p. (ORNL-1489)

This inventory lists the isotopes which have been concentrated electromagnetically, along with the completed information on their enriched abundances, and the element weights and product forms available in milligram quantities to users on AEC projects and in university and industrial laboratories. (auth)

MASS SPECTROGRAPHY

2598
PRECISION MASS SPECTROGRAPHS. COMPARISON OF EXISTING APPARATUS. J. Mattauch. Naturwissenschaften 39, 557-66(1952) Dec. (In German)

Lens and prism effects, double-focusing principles, mass scales, dispersion theory, and precision apparatus are considered in this advanced, mathematical review. 39 references. (G.Y.)

MATHEMATICS

2599
Los Alamos Scientific Lab.
EQUATION OF STATE CALCULATIONS BY FAST COMPUTING MACHINES. Nicholas Metropolis, Arianna W. Rosenbluth, and Marshall N. Rosenbluth, Los Alamos Scientific Lab. and Augusta H. Teller and Edward Teller, Chicago Univ. [nd] 23p. (AECU-2435; LADC-1359)

A general method, suitable for fast computing machines, for investigating such properties as equations of state for substances consisting of interacting individual molecules is described. The method consists of modified Monte Carlo integration over configuration space. Results for the two-dimensional rigid sphere system have been obtained on the Los Alamos Maniac and are presented here. These results are compared to the free-volume equation of state and to a four-term virial-coefficient expansion. (auth)

2600
[Los Alamos Scientific Lab.]
NOTE ON THE SCHWARZ TRIANGLE FUNCTIONS. Joseph Lehner. [nd] 9p. (AECU-2438; LADC-1363)

In his classical investigation of the hypergeometric series, Schwarz discussed the function which maps the upper half-w-plane onto a curvilinear triangle in the z-plane with $\delta\pi$, $\epsilon\pi$, $\eta\pi$; $\delta + \epsilon + \eta < 1$. This note considers the inverse, $w = \varphi(z)$, of this function which is automorphic with respect to the group got by reflecting the triangle in its sides, reflecting the new figure in its free sides, and so on. (L.M.T.)

MEASURING INSTRUMENTS AND TECHNIQUES

2601
Michigan Univ.
RADIAL RESPONSE OF TYPICAL END WINDOW GEIGER TUBES. Avraham Amith and W. Wayne Meinke. [nd] 6p. (AECU-2379)

The radial response to a collimated β-particle source of an A-filled Cl-quenched infinite-life tube (Amperex 100 C), an A-alcohol quenched tube (Tracerlab Model No. TGC 1), and an A-filled tube quenched with a small amount of Xe, O, and N (RCL Mark 1, Mod. 3X) was studied. The radial response curve for the A-quenched tube is almost identical with the theoretical curve, whereas the other tubes differ from this curve. The effect of the center wire is different in the two infinite-life tubes. When the relationship between the radial position of the source and the tube's response was measured as a function of tube voltage, the shape of the response curve remained unaltered throughout the range of voltages of the tube's plateau. Variation of plateau slope with radial position of sample was measured. (L.T.W.)

2602
Los Alamos Scientific Lab.
LARGE LIQUID SCINTILLATION DETECTORS. C. L. Cowan, Jr., F. Reines, F. B. Harrison, E. C. Anderson, and F. N. Hayes. [1952] 7p. (AECU-2436; LADC-1358)

A liquid-scintillation detector in the shape of a cylinder and containing 10.7 ft^3 of solution has been designed for the detection of the free neutrino. Two detectors of stainless steel and cold-rolled steel have been built, the tanks being baked after fabrication to remove absorbed oils and the inside surfaces coated with white Tygon paint. Three filling solutions were developed: (1) toluene containing terphenyl, 2-(1-naphthyl)-5-phenyl-oxazole (αNPO), and methyl borate (or Cd propionate in methanol), (2) triethylbenzene containing 2,5-diphenyloxazole, αNPO, and methyl borate, and (3) selected pure mineral oil containing 2,5-diphenyloxazole, αNPO, and methyl borate. These solutions provide proton densities ranging from 4.6×10^{22} to $7.2 \times 10^{22}/cm^3$. Ninety photomultiplier tubes spaced uniformly around the wall are balanced for uniform gain by means of their voltage dividers and connected in parallel in one or more banks as needed. Linear pulse amplifiers, pulse height analyzers, delayed coincidence analyzers, and scalers comprise the associated electronic equipment. (L.M.T.)

2603
Atomic Energy Research Establishment, Harwell, Berks (England)
NOTE ON TESTS OF AN ARGON PROPORTIONAL COUNTER, TYPE 1077B. G. R. Hall and P. D. Herniman. July 1950. 5p. (AERE-C/M-73)

The argon proportional counter (type 1077B) has been shown to behave statistically up to counting rates of 200,000 cpm. The dead time of the counter using two scalers in cascade has been found to be about 2 μsec. The coincidence

losses found experimentally were 0.33% at a rate of 100,000 cpm and the calculated losses at a rate of 200,000 cpm would be 0.66% and negligible (<0.05%) at rates below 20,000 cpm. (auth)

2604
Hanford Works
IN-LINE SCINTILLATION GAMMA MONITOR; PRELIMINARY SPECIFICATIONS. U. L. Upson and R. E. Connally. Jan. 22, 1953. 35p. (HW-26848)

2605
Ames Lab.
GEIGER-MUELLER COUNTERS FOR LOW ENERGY ELECTRONS. E. R. Rathbun, Jr. and E. N Jensen. Aug. 1950. 39p. (ISC-254)

One method of obtaining low-energy electron measurements in β spectroscopy is to fit G-M counters with extremely thin windows and fill them with appropriate low-pressure mixtures, using them in spectrometers in much the same manner as their more rugged counterparts. Procedures for the preparation of thin-film window materials by the glass-plate dipping technique and the drop-of-solution technique are described. A method for mounting these window materials in counters is given. Apparatus and procedures employed in the development of mixtures which will function at low pressures in G-M counters are explained. A number of different mixtures of gases and vapors were found that are of value in counters used in β spectroscopy. Data on the internal conversion and photoelectric spectra of Se^{75} were taken using four different counters, each constructed by the above-indicated techniques. They were fitted with 3.9 and 1.04 mg/cm^2 mica and 0.3 and 0.027 mg/cm^2 formvar. (auth)

2606
Mound Lab.
THE RADIOELECTRIC EFFECT. P. E. Ohmart, J. H. Hutchinson, E. H. Daggett, J. W. Heyd, and J. S. Stanton. Nov. 1, 1951. 36p. (MLM-629)

An electrostatic field will exist between two materials having different work functions when the only connection between the materials is through a load impedance. If the two materials are connected externally by a current-measuring device and the separating medium is ionized by exposure to radiation, a current of electrons will flow in the external circuit from the material of lower work function to the material of higher work function. The quantity of this current depends upon the value of the external load impedance, the type and intensity of the incident radiation, the difference between the work functions of the electrode surfaces, the type and pressure of the separating gas, and the geometry of the setup. Various radiation-measuring devices called radioelectric cells are described which have been constructed on the basis of this "radioelectric effect." Gamma detecting cells have been developed which for specific uses offer marked advantages over conventional detectors. It is also possible to detect alpha, beta, and neutron radiation and to determine the difference between the work functions of two surfaces. (auth)

2607
Radiation Physics Lab., National Bureau of Standards
CALIBRATION OF WESTINGHOUSE AND TRACERLAB PRODUCTION MODELS OF AN/PDR-18 RADIACMETERS. T. P. Loftus. Feb. 2, 1953. 23p. (NBS-2262)

Energy-dependence tests on the AN/PDR-18 radiacmeters taken from the production lines at Westinghouse and Tracerlab during Dec., 1952, were made using both 80- to 165-kev x rays and Co^{60} γ rays. The instruments were calibrated over the range of 50 to 500 r/hr and particular emphasis was placed on a study of absorption in the photomultiplier dynodes. Angular-dependence tests are also reported using 80-kev x rays. (L.M.T.)

2608
California Inst. of Tech.
NOTE ON THE USE OF CONICAL SOURCE GEOMETRY IN THE HOMOGENEOUS FIELD AXIAL FOCUSING MAGNETIC β-RAY SPECTROMETER. Jesse W. M. DuMond, Pierre E. Marmier, and James R. Wilts. [Feb. 1953] 11p. (NP-4440)

The basic ideas of the use of conical-source geometry in the homogeneous-field axial-focusing magnetic β-ray spectrometer are reviewed. As a result of improvements in background and sensitivity in working with the instrument, the authors now seriously doubt the absolute reliability of the fiducial "Q-point" from the conical sources and, consequently, the use of the method for really high absolute precision. In this note proof is given that the β rays for the case of the conical source emerge from the surface elements of the cone at a grazing angle in all cases. An alternative method which does not call for the selection of any one particular fiducial point on the β-ray line structure is now being studied, using simple disk-shaped sources. (L.M.T.)

2609
Connecticut Univ.
COUNTER RESEARCH WITH MASS SPECTROSCOPY. Stephen S. Friedland. July 1, 1952. 99p. (NYO-820)

The purposes of the studies reported were (1) to investigate the discharge mechanism in counters and its effect on the operating characteristics and life time of a counter, and (2) to determine some of the basic aspects of molecular structure from mass spectrometric measurements. In one case the dissociation of the polyatomic molecules for a number of gases was studied by extracting the gases from the counters after a definite number of counts and analyzing them with a mass spectrometer. In another experiment the self-quenching properties of NH_3 in counters was investigated. In a third experiment BF_3 counters were run at very high counting rates to determine the decomposition of the BF_3 due to counting. Finally, methods of studying molecular dissociation with a mass spectrometer are described and application is made to BF_3. (L.M.T.)

2610
Federal Telecommunication Labs., Inc.
RESEARCH AND DEVELOPMENT WORK DIRECTED TOWARD A TISSUE-EQUIVALENT IONIZATION CHAMBER [FOR] SEPTEMBER–NOVEMBER 1952; FINAL REPORT. D. K. Keel, S. Kaganoff, C. H. Mayhew, and H. G. Nordlin. Jan. 1953. 192p. (NYO-4518)

The problems associated with the development of a tissue-equivalent conductive plastic are outlined and the approach to the solution of the problem is discussed. The method of screening available N compounds is reported and the development of a suitable N-contributing additive is described. An apparatus and method for determining gas permeability values of the plastic investigated are described in detail. The procedure for making tissue-equivalent plastic is given in detail. The design of a tissue-equivalent ionization chamber, based on an earlier model, is described and reasons for the changes made and new features added are discussed. The development of the mold design for injection-molding the major parts and for compression-molding the plug is described. The fabrication of the various parts is briefly described. 245 references. (C.H.)

2611
Chalk River Project (Canada)
PROGRESS REPORT [FOR] OCTOBER 1–DECEMBER 31, 1952: ELECTRONICS BRANCH. J. Hardwick. 17p. (PR-P-16-E)

Tests were made to compare the British-developed TPBD plastic phosphor with a grown anthracene crystal. An α-contamination detector and a γ-radiation detector for

clinical use have been developed. Further measurements on the proposed circuit for a radiac survey meter for the Department of National Defense are reported. A number of aging panels and test panels have been constructed for experiments on thermionic tube life and various tests are reported. Work on the following automatic systems is reported: (1) modification of a Harwell sample changer, (2) a new AECL sample changer, and (3) an automatic eluate sampler. Precision and general-purpose log rate meters and a log radiation-survey instrument are being developed. Ruben-Mallory RM-4 cells have been tested at ~−55°F. (L.M.T.)

2612

Radiation Lab., Univ. of Calif., Berkeley

SOLID ANGLE SUBTENDED BY A FINITE RECTANGULAR COUNTER. Frank S. Crawford, Jr. Jan. 27, 1953. 4p. (UCRL-1753)

A simple formula is developed for the calculation of the integrated solid angle for the case of a rectangular detector and a point source. (L.M.T.)

2613

Radiation Lab., Univ. of Calif., Berkeley

SATURATION BACKSCATTERING CORRECTION FOR WINDOWLESS PROPORTIONAL COUNTER WITH 2π GEOMETRY. D. C. Conway and J. O. Rasmussen. Jan. 7, 1953. 6p. (UCRL-2075)

The saturation backscattering correction factor for pure β emitters for 2π counting geometry was determined using a methane-filled proportional counter with samples introduced internally. Samples of Sr^{90} (with Y^{90} in equilibrium) and of Pm^{147} were used. Backing plates of Pb, brass, Al, polystyrene, and Be were used. Noteworthy is the fact that the backscattering factor is considerably lower for 2π geometry than for 3% of 4π geometry, particularly for backing materials of large atomic number. (auth)

2614

AN IMPROVEMENT IN THE VICTOREEN 1,000-r THIMBLE CHAMBER. C. S. Simons. Nucleonics 11, No. 3, 62-3(1953) Mar.

Upon exposure of the entire length of Victoreen 1000-r thimble chambers to a broad radiation field of high-energy γ rays (>1.0 Mev), readings of 1.4 to 1.5 times greater than those with Victoreen 25-r and 100-r chambers were noted. Upon exposing the top (thimble end), middle, and bottom third of the 1000 r chambers to a narrow γ beam, the reading for the bottom third was one-half that for the top. This indicated a sensitive region in the bottom third which could contribute up to 33% of the reading obtained when the whole chamber is exposed. Upon filling the air space in the bottom with a brass plug and ceresin wax, the bottom third read only 3% of that of the top, and the top third read identically with a 100-r chamber placed at the same point. (L.M.T.)

2615

AN IMPROVED WIDE-RANGE RADIATION INSTRUMENT G. M. Burgwald and L. Reiffel. Nucleonics 11, No. 3, 46-48(1953) Mar.

The instrument utilizes the variable-gain characteristics of the 5819 photomultiplier tube used in the scintillation-counter detector (NaI crystal or a pyrene-in-xylene solution) to cover a dosage-rate range of 10^7 without side switching. A self-balancing servo-potentiometer system is employed, which by maintaining constant photomultiplier current output indicates dosage rate as a function of dynode voltage. Block and complete circuit diagrams of the instrument are given. (L.M.T.)

2616

EXTENDING THE EFFICIENT RANGE OF G-M COUNTERS. W. C. Porter. Nucleonics 11, No. 3, 32-5(1953) Mar.

The mechanism of discharge as it is presently understood is discussed in an effort to define deadtime and to convey some quantitative insight into its effect on the counting efficiency of a G-M counter. The methods which have been used to obtain improved efficiencies at high-counting rates are reviewed. The author proposes a two-tube cut-off circuit which reduces deadtime to 1.5 μsec and permits operation up to 20,000 cps with deadtime losses of only a few per cent. (L.M.T.)

2617

RECENT INSTRUMENT DEVELOPMENTS IN ENGLAND. Denis Taylor. Nucleonics 11, No. 3, 40-3(1953) Mar.

Apparatus designed for each particular task is gradually replacing the general-purpose instruments first used in the British Atomic Energy Project. Much use is being made of halogen-quenched geiger counters. The following apparatus which has been developed recently at Harwell is described: a versatile proportional counter, a new scaler circuit using decade scaling tubes, an automatic data analyzer, flame-proof monitoring instruments, logarithmic-scale survey meters, and portable bore-hole logging apparatus. (L.M.T.)

2618

USE OF PHOTOGRAPHIC EMULSIONS FOR THE DETECTION AND STUDY OF NUCLEAR PHENOMENA; HISTORY, RESULTS, AND POSSIBILITIES; BIBLIOGRAPHY. Léopold Vigneron. J. phys. radium 14, 121-7(1953) Feb. (In French)

The successive steps in the application of nuclear emulsions to nuclear and cosmic-ray physics are reviewed. The principal research techniques, essential scientific results, possibilities of emulsions, and application procedures are described briefly. 119 references. (tr-auth)

2619

AN AUTOMATIC IONIZATION CHAMBER. H. V. Neher. Rev. Sci. Instruments 24, 99-102(1953) Feb.

The ionization chamber described has the following characteristics: It recharges itself after having collected a definite charge. It generates a pulse at the instant of recharging that is easily amplified electronically. The constant of the ionization chamber is independent of the constants of vacuum tubes but does depend on the constancy of a quartz fiber, the pressure of the gas, and the potential of the charging battery. It has been successfully used to measure cosmic-ray ionization at balloon altitudes both in the United States and in northern Greenland. (auth)

2620

FACTORS INFLUENCING THE LIFE OF SELF-QUENCHING COUNTERS. Stephen S. Friedland and Henry S. Katzenstein. Rev. Sci. Instruments 24, 108-12(1953) Feb.

Utilizing two counters connected together with a valve, thus enabling the gas from one counter to be flushed into the other, the deterioration effects of the gas could be separated from those of the wire and cylinder. It is shown that the appearance of multiple pulses may be attributed to the dissociation fragments of the gas, whereas the changes in pulse height are dependent on the condition of the wire and cylinder. (auth)

2621

RANGE-ENERGY RELATIONS FOR ALPHA-PARTICLES AND DEUTERONS IN THE KODAK NTB EMULSION. O. Gailar, L. Seidlitz, E. Bleuler, and D. J. Tendam. Rev. Sci. Instruments 24, 126-8(1953) Feb. (cf. NSA 5-3471)

Range-energy relations for α particles (3 to 18 Mev) and deuterons (2 to 9 Mev) in Kodak NTB emulsion have been determined. Natural α emitters and particles accelerated in the Purdue University cyclotron were used. Cameras for use with the cyclotron and with Po and Th sources are described. In the energy interval investigated, the ranges in the NTB emulsion are practically identical with those found in the Ilford B1 and C2 emulsions. They agree also with

the ranges previously reported in dry Kodak NTA emulsion but are as much as 10% shorter than those reported for the latter emulsion when exposed under "ordinary" humidity conditions. (auth)

2622

A HIGH SENSITIVITY FISSION COUNTER. William Baer and Robert T. Bayard. Rev. Sci. Instruments 24, 138-40 (1953) Feb.

The design and performance of a sensitive, rugged fission counter is described. The counter detects thermal neutrons by means of U^{235} fission. The sensitivity of the counter is 0.7 count/neutron/cm^2 for a background counting rate of 5 counts/sec. The useful range is 10 to 2×10^5 neutrons/cm^2/sec, and the counter will operate over this range in the presence of 10^{10} γ rays/cm^2/sec. (auth)

2623

AN AUTOMATIC RECORDING GAMMA-RAY SPECTROMETER. Thomas D. Strickler and Walter G. Wadey. Rev. Sci. Instruments 24, 13-16(1953) Jan.

A scintillation spectrometer making use of a large NaI(Tl) crystal mounted on an RCA 5819 photomultiplier tube has been constructed. It was designed for the high-efficiency counting of γ rays in the energy range 0.5 to 1.5 Mev. Techniques used for crystal mounting and assembly of apparatus have proved very satisfactory for prolonged operation. Additional components have been provided for automatic recording of data. (auth)

2624

CONSTRUCTION OF EXTERNAL CATHODE GEIGER COUNTERS. R. O. Jenkins and R. W. Taylor. Rev. Sci. Instruments 24, 73(1953) Jan.

In the construction of large cosmic ray geiger counters (5 ft long) the standard 9.1-cm A-0.9-cm ethyl alcohol gas filling was used. Trouble was subsequently experienced with high-slope, short plateaus because of the occurrence of multiple pulses. Initial efforts to correct the trouble failed. It is now suggested that the cause of the phenomenon was an increase in the probability of the release of an electron under positive-ion bombardment because of a different surface condition of the glass, the difference probably being an increase of free Na in the glass. Sulfurizing treatment to remove the Na helped, but the most satisfactory cure came from the use of ethyl formate at 10 mm pressure as a quenching agent which gave 600-volt plateaus with slopes of the order of 0.03%/volt with a life 2×10^9 counts. The authors feel that the suggested use of external cathode techniques for use with halogen-filling mixtures as suggested by MacKnight and Charson (Rev. Sci. Instruments 22, 700 (1951)) is not possible because of combination of the halogen with the free Na in the soda lime glass. (L.M.T.)

2625

A NEW CLOUD-CHAMBER VALVE. B. Meyer and W. Stodiek. Rev. Sci. Instruments 24, 76(1953)

A large cloud-chamber valve with an opening time less than 3×10^{-3} sec is described. Significant is the simple construction, triggering without time lag, limited moving mass, and large free cross section. The valve is designed for cloud chambers expanding against atmospheric pressure. (auth)

2626

CONCERNING VARIOUS TECHNIQUES USED FOR THE STUDY OF SCINTILLATIONS. M. Ageno and R. Querzoli. Rend. ist. super. sanità 15, 395-8(1952). (In Italian)

The authors' experimental findings that in the fluorescence of a liquid scintillator there is a transport of energy through several millimeters of the solution are discussed briefly, and the inconsistencies of some criticisms of these studies are pointed out. (G.Y.)

2627

INTERACTION OF MANGANESE ACTIVATOR IONS IN ZINC-ORTHOSILICATE PHOSPHORS. Simon Larach and John Turkevich. Phys. Rev. 89, 1060-5(1953) Mar. 1.

A study was made of specially prepared rhombohedral Zn_2SiO_4:Mn phosphors, utilizing magnetic, chemical, and luminescence techniques. From measurements of Weiss constants, it is shown that magnetic interaction occurs between Mn activator ions. The magnetic interaction increases with increasing proportion of Mn in the range where the following related luminescence characteristics decrease: (1) efficiency, (2) temperature break point, and (3) decay time. An analysis of the magnetic data shows that isolated noninteracting Mn activator ions have five unpaired electrons, corresponding to Mn^{2+}, and $\bar{\mu} = 5.90$ Bohr magnetons (5.92 theoretical). The molar diamagnetic susceptibility of zinc-orthosilicate was determined as being $-64.6 \pm 0.7 \times 10^{-6}$. 32 references. (auth)

MESONS

2628

Radiation Lab., Univ. of Calif., Berkeley

EVIDENCE FOR THE ANGULAR DISTRIBUTION OF NEGATIVE PIONS PRODUCED IN n-n COLLISIONS. L. K. Neher. Jan. 20, 1953. 7p. (UCRL-2086)

Charged pions from the 300 ± 30-Mev neutron bombardment of C^{12} and Be^9 were detected by two time-of-flight detectors arranged symmetrically with respect to a 15,000-gauss magnetic field. A pion passed through a front counter, into the deflecting field and finally into one of the rear counters, the slower-moving scattered protons being rejected. The center energy of the detector was held constant at 70 Mev as the angle of observation was varied from 15 to 125° to the neutron beam. The differential cross sections per nucleus for π^- mesons from Be^9 and C^{12} in the lab. system and after being transformed to the center-of-mass system are shown, the data having been corrected for energy loss, scattering, decay in flight, and counter efficiency. (L.M.T.)

2629

A NEW EXAMPLE OF THE τ MESON. M. Ceccarelli, N. Dallaporta, N. Merlin, and A. Rostagni. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 13, 9-14(1952) July-Aug. (In Italian)

A three-prong event observed in Ilford G5 emulsion exposed at 4550 m includes the track of a τ meson of 997 ± 100 m_e mass. (G.Y.)

2630

SLOW κ MESONS EMITTED IN COSMIC-RAY STARS. Jean Crussard, Louis Leprince-Ringuet, Daniel Morellet, Agnès Orkin-Lecourtois, and Jacques Trembley. Compt. rend. 236, 872-4(1953) Mar. 2. (In French)

Three tracks of κ mesons having their origins in multipronged stars and ending in the emulsions have been analyzed. The averaged mass of the κ meson, found by ionization and scattering measurements, was 940 ± 40 m_e, close to that of the τ meson, and compatible with the κ mass values found by other investigators. (G.Y.)

2631

NEUTRAL MESON PRODUCTION IN n-p COLLISIONS. Roger H. Hildebrand. Phys. Rev. 89, 1090-2(1953) Mar. 1

The angular distribution of neutral pions formed by 400-Mev neutrons in the process $n + p \rightarrow d + \pi^0$ has been measured using an experimental arrangement in which both of the π^0 decay γ rays are detected in coincidence with the deuteron. The results can be described in the c.m system by the function $\cos^2\theta + 0.2$. The agreement between this distribution and the π^+ distribution of the process $p + p \rightarrow$

$d + \pi^+$, which has been measured by Whitehead and Richman and by Durbin, Loar, and Steinberger, gives evidence in support of the hypothesis of charge independence in meson-nucleon interactions. (auth)

2632
ATOMIC NUMBER DEPENDENCE OF NEUTRAL MESON YIELD FROM PROTON BOMBARDMENT. R. W. Hales and B. J. Moyer. Phys. Rev. 89, 1047-53(1953) Mar. 1. (cf. UCRL-1836; NSA 6-4597)

The relative yield of neutral mesons from various elements in the reaction (p, π^0) has been determined. Single photons from neutral-meson decay were observed at 135° to the proton beam (lab.). Detection was by means of a pair-scattering detector composed of a converter and two anthracene crystal telescopes in juxtaposition. The yield in the range of elements from H to Na is essentially proportional to the number of neutrons; in the elements Al to Pb it is proportional to $(N/A)A^{\frac{5}{3}}$. 15 references. (auth)

2633
THE GAMMA-RAYS FROM NEGATIVE μ-MESON CAPTURE IN LEAD. Gerard G. Harris and T. J. B. Shanley. Phys. Rev. 89, 983-90(1953) Mar. 1.

The γ rays produced when a negative μ meson stops in Pb have been studied by means of a cloud chamber in a magnetic field. The presence of these γ rays is confirmed. It is concluded that both nuclear γ rays and Bohr-orbit γ rays are necessary to explain the experimental data. (auth)

MICROWAVES

2634
MICROWAVE ABSORPTION SPECTRUM OF ND_3. R. G. Nuckolls, L. J. Rueger, and Harold Lyons. Phys. Rev. 89, 1101(1953) Mar. 1.

The main J = K sequence of inversion lines of the ND_3 absorption spectrum were observed and measured between 1589 and 2540 Mc. Quantum numbers up to J,K = 18,18 were assigned by the use of an approximate empirical formula. (auth)

2635
A MICROWAVE SPECTRUM OF THE FREE OH RADICAL. T. M. Sanders, Jr., A. L. Schawlow, G. C. Dousmanis, and C. H. Townes. Phys. Rev. 89, 1158-9(1953) Mar. 1.

A strong microwave absorption spectrum resulting from the free radical $O^{16}H^1$ is reported. The radicals are produced in a r-f discharge through H_2O vapor. The vapor flows continuously through the discharge and the absorption cell, at a pressure near 0.1 mm Hg. The intensity of the lines is strongly dependent both on discharge current and on pressure. (auth)

MOLECULAR PROPERTIES

2636
ADDITIONAL REMARKS CONCERNING THE DETERMINATION OF MOLECULAR WEIGHT BY EFFUSION. W. Mund, J. Feyten, and P. Huyskens. Translated by R. C. Bacon from Bull. classe sci., Acad. roy. Belg. (5) 38, 770-9(1952). 10p. (AEC-TR-2009)

NEUTRONS

2637
A HIGH TRANSMISSION SLOW NEUTRON VELOCITY SELECTOR. J. G. Dash and H. S. Sommers, Jr. Rev. Sci. Instruments 24, 91-6(1953) Feb.

A high-intensity neutron monochromator for the subthermal energy region is described. The instrument utilizes the velocity selectivity of a rotating helix. A complete analysis is made of the instrument resolution for several practical constructions. For wavelengths longer than 1A, a mechanical selector may yield resolutions of 1.0 to 0.1 and fractional transmissions of 60%. Design and tests of a selector are described and compared with the theory. (auth)

NUCLEAR PHYSICS

2638
Bartol Research Foundation, Franklin Inst.
SECOND ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. Sept. 30, 1952. 152p. (NP-4300)

A review of the work completed or in progress to Sept. 30, 1952 includes instrumentation and some nuclear reactions relating to the Van de Graaff generator; γ radiations from Zr^{95} and Nb^{95}; specific primary ionization of H_2, He, Ne, and A by high-energy electrons; spreading of the discharge in self-quenching counters operated below the G-M threshold; α-particle-induced phosphorescence of Ag-activated NaCl; performance of the large Van de Graaff generator and linear accelerator. Reprints of published reports are included. (See NP-3729 for previous period) (J.E.D.)

2639
Carnegie Inst. of Tech.
THEORY OF NUCLEAR REACTIONS INVOLVING POLARIZED DEUTERONS. W. Lakin and L. Wolfenstein. [nd] 33p. (NP-4433)

The following are discussed under the 4 different sections of the report: (1) ways of describing the polarization of particles of spin 1, such as the deuteron, (2) the restrictions which the usual invariance requirements place upon the spin dependence of transition amplitudes, (3) the polarization of the deuterons produced in the $p + p \rightarrow \pi^+ + d$ reaction, and (4) the use of elastic d-p scattering as a possible means of detection of polarization of the deuterons in (3). (L.M.T.)

2640
SYMMETRIC PSEUDOSCALAR THEORY OF NUCLEAR FORCES. Abraham Klein. Phys. Rev. 89, 1158(1953) Mar. 1.

In his recent work on the problem of nuclear forces (Phys. Rev. 88, 72, 725(1952)), Lévy employed a form of 3-dimensional perturbation theory to deduce an adiabatic nuclear potential from the symmetric pseudoscalar theory with pseudoscalar coupling. The purpose of this letter is to report a number of errors in the Lévy potential. (auth)

2641
ADVANCES IN KNOWLEDGE OF NUCLEAR FORCES. G. Breit and M. H. Hull, Jr. Am. J. Phys. 21, 184-220(1953) Mar.

The paper is primarily a review article covering work within the last five years preceding the summer of 1952. The principal features of experimental results on nucleon-nucleon scattering are summarized. The main conclusions of the theory of nuclear forces are reviewed with an attempt at a distinction between knowledge and speculation. The photoelectric effect of the deuteron, evidence regarding isobaric states from meson physics, the proof of the pseudoscalar character of the π meson are briefly discussed as part of the main problem, and a partial account is given of relevant progress in the fields of binding energies of light nuclei and shell theory. 167 references. (auth)

2642
THE FERMI TERM IN $\beta-\nu$ CORRELATION. D. C. Peaslee. Phys. Rev. 89, 1148-9(1953) Mar. 1.

A survey was made to find the β transitions most suitable for a $\beta-\nu$ (recoil) correlation experiment to determine the Fermi part of the β-decay interaction. From the isotopes investigated, N^{13}, O^{15}, F^{17}, Ne^{19}, Cl^{33}, and A^{35} the most favorable parent appears to be A^{35}. (auth)

NUCLEAR PROPERTIES

2643

Brookhaven National Lab.

EXCITED STATES OF EVEN-EVEN NUCLEI. Gertrude Scharff-Goldhaber. [nd] 41p. (BNL-1356)

A general survey of excited states of even-even nuclei yields the following results: The nth excited state has usually a spin $I \leq 2n$. For n = 1, the assignment I = 2+ (even parity) is compatible with experimental results for 66 out of 68 nuclei investigated. For n = 2, of 26 nuclei investigated, about one third have I = 2+, one third I = 4+, and one third miscellaneous spins of both even and odd parities. The energy of the first excited state plotted against the number of protons or neutrons in the nucleus varies rather smoothly and reaches maxima at closed shells. Wherever the first excited state is very low, e.g. in the rare earths region and for the heavy elements from thorium up, the one particle model for odd-A nuclei is likely to break down except for the ground state. The lack of isomers of odd-proton nuclei below magic number 82 may be due to this fact. The average energy of the first excited state of the even-even core in this region is of the order of 0.1 Mev, whereas this energy is of the order of 0.5 Mev for the core of the corresponding odd-neutron nuclei (N < 82). Isomerism in even-even nuclei is discussed. The results are compared with theoretical predictions derived from an extended j-j coupling model and from the liquid drop model of the nucleus. (161 references) (auth)

2644

NUCLEAR QUADRUPOLE RESONANCE IN SOME METAL CHLORIDES AND OXYCHLORIDES. H. G. Dehmelt. J. Chem. Phys. 21, 380(1953) Feb.

Absorption lines due to nuclear quadrupole resonance of the chlorine isotopes Cl^{35} and Cl^{37} have been detected in the compounds $AlCl_3 \cdot O(C_2H_5)_2$, $SiCl_4$, $SnCl_4$, $SnCl_4 \cdot O_2NC_6H_5$, $TiCl_4$, $VOCl_3$, CrO_2Cl_2, and MoO_2Cl_2. (G.Y.)

2645

NUCLEAR SPIN AND MOMENTS OF PALLADIUM 105. Jean Blaise and Henri Chantrel. J. phys. radium 14, 135 (1953) Feb. (In French)

Study of the hfs of six violet lines of the arc spectrum of natural Pd has confirmed the value $I = 5/2$ given by Brix and Steudel as the most probable spin of Pd^{105} and has definitely excluded the values $3/2$ and $7/2$. The value $\mu = -0.57$ n.m. for the magnetic moment also has been confirmed. (G.Y.)

2646

ELECTRONIC PARAMAGNETIC RESONANCE; HISTORY AND PRINCIPAL RESULTS. Jean Uebersfeld and Jean Combrisson. J. phys. radium 14, 104-10(1953) Feb. (In French)

A brief review of the subject, indicating the information on nuclear spins and quadrupole moments that can be obtained by the method, is presented. 149 references. (G.Y.)

2647

NUCLEAR QUADRUPOLE RESONANCE OF $CH_2ClCOOH$. André Bassompierre. Compt. rend. 236, 799-800(1953) Feb. 23. (In French)

An expression for the resonance is derived. (G.Y.)

2648

INVESTIGATION OF THE QUADRUPOLE RESONANCE LINE OF p-DICHLOROBENZENE. Yves Ayant and Maurice Buyle-Bodin. Compt. rend. 236, 800-2(1953) Feb. 23. (In French)

Contributions of the various components of the quadrupole resonance line are calculated. In this compound the width of the line is determined essentially by spin-spin coupling. (G.Y.)

2649

MAGNETIC MOMENTS OF Si^{29}, S^{33}, Zn^{67}, As^{75}, Se^{77}, Te^{123}, AND Te^{125}. H. E. Weaver, Jr. Phys. Rev. 89, 923-30 (1953) Mar. 1.

An improved nuclear-induction spectrometer has been employed for the detection and measurement of the resonances of several stable nuclei. The sign and value of the magnetic moments are listed. No diamagnetic correction has been applied. The sensitivity of the apparatus is indicated by photographs of the output signal of H^2 and O^{17} which occur in water with a natural abundance of 0.02 and 0.04%, respectively. 34 references. (auth)

2650

OBSERVATION OF FORBIDDEN COMPONENTS DUE TO NUCLEAR SPIN IN THE ZEEMAN EFFECT. Jean Brochard and Pierre Jacquinot. J. phys. radium 14, 132-3(1953) Feb. (In French)

Detection of nuclear spins by study of the forbidden components of the Zeeman effect should be possible with sufficiently intense sources. The effect has been observed in the Na spectrum in a 30,000-gauss field. (G.Y.)

NUCLEAR REACTORS

2651

AN ENHANCED REACTOR. F. E. O'Meara. Phys. Rev. 89, 982(1953) Mar. 1.

The possibility of using a thermal U reactor to induce secondary fusion reactions is examined. Deuterons and tritons are accelerated by collisions with neutrons and fission fragments and the resulting D-T reactions are calculated to yield 10^{-3} neutron per fission. (auth)

2652

COUNTING METHOD PERMITTING MEASUREMENT OF THE MULTIPLICATION FACTOR IN A PILE. Victor Raievski. Compt. rend. 236, 693-5(1953) Feb. 16. (In French)

Comparison of measurements of the neutron density at subcritical levels permits determination of the multiplication factor. The procedure is compared with the kinetic method. (G.Y.)

2653

MEASUREMENT OF REACTIVITY. Jacky Weill. Nucleonics 11, No. 3, 36-9(1953) Mar.; J. phys. radium 14, 77-81(1953) Feb.

Three procedures for measuring pile reactivity are described. The first, already known, consists in measuring the power level with logarithmic amplifier, then taking the derivative of the logarithm of the power. The two other procedures are based on the quotient between the derivative of the power and the power itself. The two methods are: (1) formation on an oscilloscope screen of a straight line resulting from applying an alternating voltage proportional to dP/dt to the vertical deflection plates and an alternating voltage proportional to P and in phase with the first voltage to the horizontal deflection plates; the tangent of the angle made by the straight line with the horizontal is proportional to the reactivity; (2) use of an automatic recording potentiometer functioning as a quotient meter. The last procedure is that used at the control panel of the Saclay pile. (G.Y.)

NUCLEAR TRANSFORMATION

2654

Los Alamos Scientific Lab.

THE DISINTEGRATION OF Sr^{91} AND Y^{91m}. D. P. Ames, M. E. Bunker, L. M. Langer, and B. M. Sorenson. [nd] 27p. (AECU-2434; LADC-1277)

The radiations from the fission product Sr^{91} (9.67 hr) and its daughter isomer Y^{91m} (50.3 min) have been studied using a magnetic-lens spectrometer, a high-resolution 180° focusing spectrometer, and a scintillation spectrometer.

Coincidence measurements were made to check on certain genetic aspects of the decay scheme. Five β-ray groups are observed with endpoint energies and relative intensities of 2.665 Mev, 26.4%; 2.03 Mev, 4.1%; 1.359 Mev, 29.2%; 1.093 Mev, 33.1%; and 0.62 Mev, 7.2%. The 2.665-Mev group has a shape characteristic of a once-forbidden transition involving a spin change of 2 units. Gamma-rays are found with energies of 1.413, 1.025, 0.93, 0.748, 0.645, and 0.5512 Mev. The 50.3-min isomeric level in Y^{91} decays only by γ emission to the ground state. The 0.5512-Mev γ ray associated with this transition has a K/(L + M) internal conversion ratio of 6.00, which is consistent with an M4 assignment. A disintegration scheme is proposed. (auth)

2655

Los Alamos Scientific Lab.

GAMMA RAYS FROM 14-MEV NEUTRON BOMBARDMENT OF C, O, Al, Fe, AND Pb. M. E. Battat, R. W. Davis, and A. H. Frentrop. Jan. 1953. 36p. (LA-1507)

The cross sections for the production of γ rays were measured for 14-Mev neutrons incident on C, O, Al, Fe, and Pb. A counter telescope, consisting of three thin-walled Al proportional counters arranged in a line, was used to detect the γ rays. Al was used as the converter and absorber material. The counters were connected to a circuit which registered triple coincidences, and also coincidences between counters 2 and 3 with counter 1 in anticoincidence. The counter telescope was calibrated with γ-ray sources of known energy and intensity, and the absorption curves were analyzed by the method of Bleuler and Zunti. (auth)

2656

Radiation Lab., Univ. of Calif., Berkeley

SECONDARY PARTICLES RESULTING FROM 375 MEV ALPHA BOMBARDMENT OF NUCLEI. R. W. Deutsch. Feb. 4, 1953. 7p. (UCRL-2098)

Thin targets of Be, Al, Ni, Ag, Au, and U were bombarded by 375-Mev α particles of the 184-in. cyclotron. Secondary particles then spiral down into Ilford C2, 200-μ nuclear track plates located at 3 positions below the median plane of the cyclotron (see Phys. Rev. 89, 1(1953) for a description of the apparatus and method of analysis). The secondary particles are shown, and their mean energies in each position, and each element is normalized to 100% for the no. of particles found per unit solid angle per unit radius of curvature interval. (L.M.T.)

2657

THE ANGULAR DISTRIBUTION OF $Be^9(d,t)Be^8$ AT LOW ENERGY. P. Cüer and J. J. Jung. Phys. Rev. 89, 1151-2 (1953) Mar. 1.

The angular distribution of the tritons from the $Be^9(d,t)$ reaction at 1.3 Mev were studied. A circular camera was built with a hollow target holder in the middle at an angle of 60° with the incident 3-mm collimated deuteron beam. From 0 to 150° (at 30° intervals) the solid angle was defined in good geometry conditions by two 3-mm circular holes bored in two concentric rings 10 cm apart. A second camera was used to register distributions accurately at 0, 7, 10, 15, 20, and 30° angles. Angular distributions in the c.m. system are given for $Be^9(d,t)Be^8$, $Be^9(d,p)Be^{10}$, and $C^{12}(d,p)C^{13}$ reactions, the results for each angle being the mean of several exposures giving a great number of tracks. (L.M.T.)

2658

INTERACTION OF NUCLEONS OF SEVERAL HUNDRED MEV WITH NUCLEONS AND NUCLEI. J. Heidmann. J. phys. radium 14, 111-20(1953) Feb. (In French)

A résumé of recent results obtained in the study of interactions of nucleons with nucleons and nuclei at energies now accessible in large accelerators is presented. Meson phenomena are not considered. General aspects of the phenomena are extracted from the experimental facts. Parallelly, theoretical interpretations and implications are presented in an intuitive form. (tr-auth)

2659

ANGULAR DISTRIBUTION OF PROTONS FROM VANADIUM 52. J. S. King and W. C. Parkinson. Phys. Rev. 89, 1080(1953) Mar. 1.

Angular distributions have been obtained for the protons from the ground and first excited states for the reaction $V^{51}(d,p)V^{52}$. The results indicate that the captured neutron carries in mainly one unit of orbital angular momentum for both states. The 29th neutron is thus presumed to be a $p_{1/2}$ nucleon. (auth)

2660

IDENTIFICATION OF THE SEVEN-HOUR Mo^{93} ISOMER. D. E. Alburger and S. Thulin. Phys. Rev. 89, 1146(1953) Mar. 1.

A direct mass assignment of a 7-hr isomer has been made to Mo^{93} after bombarding Nb metal powder with deuterons and examining the product in the isotope separator at Nobel Institute. Strong lines were obtained by placing the irradiated powder in the separator ion source and letting Cl_2 gas pass through the powder. Separation was carried out for 2 hr at a current of 1 to 3 μa on a 2.5 mg/cm² Al collector foil. By counting areas of the collector from 88 through 97 mass numbers and also from a radioautograph of the foil it was established that the only activity present was at mass 93. Internal and external conversion spectra from respective separated and unseparated Mo^{93} samples are shown. (L.M.T.)

2661

MOLYBDENUM 90. R. M. Diamond. Phys. Rev. 89, 1149-50(1953) Mar. 1.

Nb metal foils were bombarded with 55- to 60-Mev protons and the Mo activities were isolated by ether extraction from 6N HCl. Gross decay curves showed a 5.5- to 6-hr and a 14.5- to 15-hr activity, and the decay curve of a sample separated quickly after bombardment exhibited an additional 15- to 20-min activity ascribable to Mo^{91}. It was thought that since Nb^{90} has a 15-hr half life, the observed activities were due to a new nuclide, Mo^{90}, decaying with a 5.5- to 6.0-hr period into Nb^{90}. This was confirmed by adding Nb carrier to purified Mo fractions and precipitating, in one case, Nb away from the Mo with NH_3, and in two cases, separation by ether extraction of Mo away from Nb and HCl and subsequent counting. In all 3 series a plot of the yield of Nb daughter activity vs. time showed a slope of 5.7 ± 0.2 hr, and all samples showed a decay period of 14.7 ± 0.2 hr. The decay of Mo^{90} is predominantly by 3 γ's. (L.M.T.)

2662

Q VALUES FOR THE $N^{14}(\alpha,p)O^{17}$ REACTION. Elis Hjalmar and Hilding Slatis. Phys. Rev. 89, 1151(1953) Mar. 1.

Q values for the $N^{14}(\alpha,p)O^{17}$ reaction determined by using the arrangement described (Phys. Rev. 81, 641(1951)) were −1.16 and −2.02 Mev. These results are in good agreement with those of Roy (Phys. Rev. 82, 227(1951)). (L.M.T.)

2663

PHOTOFISSION AND PHOTONEUTRON EMISSION IN URANIUM. Robert B. Duffield and John R. Huizenga. Phys. Rev. 89, 1042-6(1953) Mar. 1.

The yields of the two reactions $U^{238}(\gamma,n)U^{237}$ and $U^{238}(\gamma,$ fission) produced by bremsstrahlung have been measured as a function of the maximum energy of the x-ray spectrum. The ratio of the number of fissions to the number of U^{237} atoms produced decreased from 0.390 at 8 Mev to 0.275 at 12 Mev and then increased to 0.465 at 22 Mev. These data are interpreted to show that for maximum x-ray energies in excess of 12 Mev, a fraction of the U^{237} atoms formed

by the (γ,n) reaction are left with sufficient excitation energy that fission or secondary neutron emission can occur. The cross sections for the reactions as a function of γ ray energy have been calculated from the yield data. 22 references. (auth)

PARTICLE ACCELERATORS

2664

Brown Univ.

R-F COCKCROFT-WALTON GENERATOR FOR NEUTRON STUDIES: SECOND PROGRESS REPORT. Russell A. Peck, Jr. Issued Dec. 10, 1952. 29p. (NYO-965)

Changes in design and some details of component behavior in testing and development phases are reported. Present performance provides from 20 to 40 kv per box, with different degrees of stability, and 2 ma of focused current from the ion source. Advances in detection instrumentation and related non-contract work are noted, and immediate agenda outlined. The nuclear research program for this accelerator and the specific context of the projected (n,p) and (n,d) studies at 14 Mev are discussed. (auth)

2665

ION OPTICS IN LONG, HIGH VOLTAGE ACCELERATOR TUBES. Mortimer M. Elkind. Rev. Sci. Instruments 24, 129-37(1953) Feb.

In the past, the ion optics of long, high-voltage accelerator tubes has been a problem usually dealt with experimentally. Based upon a description of a high-voltage tube presented by McKibben, a first-order focusing theory is developed essentially through the combined application of geometric optics and Gans' method. The analysis indicates the need for a description of the optical properties of the ion source and its associated electrodes before focusing, magnification, and other characteristics of the over-all accelerator tube can be determined. The application of the theory to a tube and a simple source system is illustrated by an analysis of the focusing characteristics of the Rockefeller accelerator at M.I.T. The results of this analysis yield computed focusing voltages in agreement with those used. (auth)

2666

RADIAL OSCILLATIONS IN THE CYCLOTRON. P. V. C. Hough. Rev. Sci. Instruments 24, 42-8(1953) Jan.

The excitation and evolution of the radial oscillations of ions in the cyclotron has been studied theoretically and experimentally. A simple method for calculating the pattern of the oscillations leads to detailed criteria for the preparation of the magnetic field and a systematic theory of shimming. A new method for measuring the pattern of the oscillations is used to check the theory. The results are applied briefly to the problem of beam extraction. (auth)

2667

A TELEMETERING SYSTEM FOR A LARGE ELECTROSTATIC ACCELERATOR. C. W. Johnstone, J. F. Kalbach, and H. J. Lang. Proc. I. R. E. 40, 1664-74(1952) Dec.

A telemetering system is described for controlling and monitoring the ion source, focusing, and belt charging in the high-voltage electrode of the large d-c electrostatic accelerator nearing completion at Los Alamos. Time-modulated pulsed light beams are the transmission media from grounded electrode to high-voltage electrode and provide 16 independent channels. (auth)

2668

A FOCUSING METHOD FOR LARGE ACCELERATORS. T. Kitagaki. Phys. Rev. 89, 1161-2(1953) Mar. 1.

A variation of the method suggested by Courant, Livingston, and Snyder (Phys. Rev. 88, 1190(1952)) as regards the periodic field is proposed. The magnet is divided into guiding and focusing magnets, the latter being placed in the linear portion of the field. Quadrupole or solenoid magnets may be used as focusing magnets. Theoretical treatment is given the stability condition for design examples of a 500-Mev electron synchrotron, and a 100-bev proton synchrotron. (L.M.T.)

2669

THE OPERATING PRINCIPLES OF SYNCHROTRON ACCELERATORS I. S. Blumenthal. Am. J. Phys. 21, 164-70 (1953) Mar.

The synchrotron accelerator has many varieties. Some confusion exists in the widely scattered literature on particle accelerators as to the basic similarities and differences of the various types. This confusion is partly due to indistinct designation. In this review paper each variety is designated and described as a logical derivation from a previous type, and the basic principle of operation of each is described in turn. Factors governing oscillations in phase and in orbit are listed and described. Basic references are presented covering each point. 24 references. (auth)

RADIATION ABSORPTION AND SCATTERING

2670

Massachusetts Inst. of Tech.

INTERPRETATION OF DIFFUSE X-RAY SCATTERING FROM POWDER PATTERNS OF SOLID SOLUTIONS. P. A. Flinn, B. L. Averbach, and P. S. Rudman. Mar. 1, 1953. 38p. (NYO-3813; Technical Report No. 15)

Methods are developed for the evaluation of the fourier coefficients which measure the local order and the sizes of atoms in solid solution. A transform of the diffuse scattering from polycrystalline samples modified by an exponential weighting function is used to obtain these coefficients with a minimum of false detail. Two experimental examples are given. Measurements of the diffuse intensity in electron units from an Al-Zn alloy at 400°C show that Zn-rich clusters exist in the equilibrium solid solution above the solubility temperature. Similar measurements for a Ni-Au solid solution indicate a preference for unlike neighbors above the solubility gap. In the latter system the diffuse intensity produced by the difference in atomic radii is also observed. (auth)

2671

Massachusetts Inst. of Tech.

MEASUREMENTS OF CLUSTERING IN SOLID Al-Zn ALLOYS. P. S. Rudman, P. A. Flinn, and B. L. Averbach. Mar. 1, 1953. 5p. (NYO-3814; Technical Report No. 16)

Measurements were made of the x-ray diffuse scattering from solid solutions of Al containing up to 50 at.% Zn. Observations were made at 400°C which is above the solubility gap and all of the alloys were single phase f.c.c. solutions. Polycrystalline transmission samples were used and data were obtained by a combination of photographic and geiger-counter spectrometer methods using Co Kα radiation monochromated by a bent fluorite crystal. Representative data obtained from an alloy containing 20 at.% Zn and a fourier transform of the corrected intensity are shown. (auth)

2672

Massachusetts Inst. of Tech.

THE DIFFUSE "SCATTERING OF X-RAYS." B. E. Warren and B. L. Averbach. Mar. 1, 1953. 72p. (NYO-3815; Technical Report No. 10)

Any sort of randomness or distortion in a material gives rise to a diffuse scattering of x rays in addition to the sharp crystalline reflections. It is only from quantitative measurement of the diffuse scattering that detailed information about the nature of the randomness can be obtained. This article

surveys the nature of the diffuse scattering and the kinds of information obtainable for four kinds of crystal imperfection: the temperature diffuse scattering resulting from temperature vibration, the broadening of reflections by cold work distortion, the diffraction effects of short-range order in alloys, and the effects of clustering and difference in size of the atoms. (auth)

2673

RANGE-ENERGY CURVES FOR POSITIVE IONS WITH CHARGE GREATER THAN ONE IN NUCLEAR EMULSIONS. J. P. Lonchamp. J. phys. radium 14, 89-95(1953) Feb. (In French)

The author assembles all the data relative to the range-energy curve for α particles in Ilford emulsions and proposes a weighted curve for the region 0 to 10 Mev. He then examines the case of fragments with $Z > 2$, taking into account the variations in ionic charge in the low-energy region. A relation of the form $R_v = R_{av}(M/Z^2) + C(Z,M)$ is proposed. The constant C is calculated up to $Z = 14$. The range-energy curve for the C^{12} ion is improved. (tr-auth)

2674

ENERGY LOSS AND ČERENKOV RADIATION OF A RELATIVISTIC IONIZING PARTICLE. P. Budini. Phys. Rev. 89, 1147-8(1953) Mar. 1.

In the energy region where bremsstrahlung is not effective the energy lost by a relativistic ionizing particle in traversing a material medium contributes to (a) ionization of the atoms of the medium, (b) excitation of the atoms, and (c) emission of the Cherenkov radiation. Formulas are given for these three cases and calculations are carried out for AgBr. A comparison of theoretical results is made with the experimental results of Moorish (Phil. Mag. 43, 533 (1952)) and Daniel et al. (Phil. Mag. 43, 753(1952)). (L.M.T.)

2675

SYSTEMATIC CALCULATIONS OF GAMMA-RAY PENETRATION. Herbert Goldstein, J. Ernest Wilkins, Jr., and L. V. Spencer. Phys. Rev. 89, 1150(1953) Mar. 1.

This note is preliminary to report NYO-3075 which will be published at a later date. The required flux distribution function of penetrating γ rays in a medium can be approximated from a knowledge of a finite number of its spatial moments, the method here being an expansion in terms of an appropriate system of polynomials. Final computations are now in progress with the SEAC, the NBS calculating machine, for the entire periodic table, and for most of the substances both point-isotropic and plane-monodirectional source data are being obtained. In the computations it has been assumed that the only scattering process is incoherent Compton scattering of unpolarized γ rays. (L.M.T.)

2676

EXCITATION CROSS SECTION FOR HELIUM ATOMS. II. Saul Altshuler. Phys. Rev. 89, 1093-5(1953) Mar. 1.

The excitation scattering of electrons from He atoms is investigated for the case of transition to the first excited singlet metastable level in order to examine quantitatively the error introduced by the fact that the description of the He target is only approximately known. The cross section is calculated in Born approximation using formally equivalent matrix elements which weight the wave functions differently in space. The shape of the total cross section-energy curve is the same although absolute values differ while the angular distributions are considerably different. (auth)

2677

ELECTRON-ELECTRON SCATTERING AT 6.1 MEV. W. C. Barber, G. E. Becker, and E. L. Chu. Phys. Rev. 89, 950-7(1953) Mar. 1.

The absolute differential cross section for the scattering of 6.1-Mev electrons by the electrons in a Be foil has been measured at 90 and 109° (c.m.). Electrons from a linear accelerator were first magnetically analyzed and then collimated to form the incident beam. Electron-electron scattering events were detected by end-window Geiger counters connected in coincidence. The counter with the defining aperture was connected in coincidence (1) with a counter at the conjugate scattering angle, lying in the plane determined by the incident beam and the scattering direction to the defining counter; and (2), with another counter at the conjugate angle, but lying outside this plane, thus counting only accidental coincidences. The number of e-e coincidences was then given by the difference between (1) and (2), with appreciable corrections arising from asymmetry in the background and from dead-time losses. These corrections required measurements of single and coincidence-count rates with the scatterer in and out of the beam. The result at 109° was 4.4% lower than that predicted by the Møller theory, with a standard deviation based on the number of counts recorded of ±6%. At 90° the expected standard deviation was ±2%, and here the experimental result was 8% below the theoretical. The latter result suggests the possibility that the Møller theory overestimates the cross section. However, consideration of the effects produced by radiative collisions, and of possible systematic errors in the experiment, leads to the conclusion that the experimental result is not incompatible with the Møller theory. (auth)

2678

TABLES FOR SECOND BORN APPROXIMATION SCATTERING FROM VARIOUS POTENTIAL FIELDS. Lyman Mower. Phys. Rev. 89, 947-9(1953) Mar. 1.

By means of a variational approach, the scattering amplitude for electron scattering from various potentials is calculated. Numerical values for the functions involved are tabulated as a function of energy and scattering angle. (auth)

2679

AN UPPER LIMIT FOR ATOMIC ORBITAL ELECTRON EJECTION ACCOMPANYING K-CAPTURE IN Fe^{55}. F. T. Porter and H. P. Hotz. Phys. Rev. 89, 938-40(1953) Mar. 1.

An upper limit has been determined for the number of atomic orbital electrons ejected during the decay of Fe^{55} by orbital capture. From cloud-chamber observations it is concluded that less than 0.6×10^{-6} electron are ejected per disintegration with energies in the range 30 to 205 kev. The theoretical prediction gives the order of 10^{-6} electron per disintegration for the frequency of the process in the energy range studied. (auth)

2680

ELEVEN-MEV THICK TARGET BREMSSTRAHLUNG. J. W. Motz, William Miller, and H. O. Wyckoff. Phys. Rev. 89, 968-71(1953) Mar. 1.

The intensity distribution of the photons in the forward direction from the 60-mil W-wire target of the U. S. Naval Ordnance Lab. 11-Mev betatron was determined in an energy range of 0.3 to 12 Mev from measurements made with a magnetic Compton spectrometer. The experimental results showed good agreement with the Bethe-Heitler bremsstrahlung theory after corrections were made for target thickness effects and the absorption produced by materials in the path of the photon beam. The photon-energy flux density for the measured spectrum was converted to an equivalent roentgen rate value, which agreed within 10% with the value obtained from measurements made with a Victoreen thimble chamber. (auth)

2681

MOMENTUM TRANSFER AND ANGLE OF DIVERGENCE OF PAIRS PRODUCED BY PHOTONS. A. Borsellino.

Phys. Rev. 89, 1023-5(1953) Mar. 1.

The distribution of the momentum transferred to the pairs in pair production by photons has been derived from the Bethe-Heitler cross section. The effect of screening is evaluated using a shielded coulomb potential for the nucleus. In the last part of the article the distribution of the angle of divergence of the pair is obtained, and the most probable angle of divergence is given by $\phi(E_+/k)\text{-}4mc^2/k$, where k and E_+ are the energies of the photon and the positron and $\phi(E_+/k)\sim 1$ for $0.2<E_+/k<0.5$. (auth)

2682

MULTIPLE COMPTON SCATTERING OF LOW ENERGY GAMMA-RADIATION. R. C. O'Rourke. Phys. Rev. 89, 999-1003(1953) Mar. 1. (cf. NSA 6-2762)

The exact problem of multiple Compton scattering in an infinite plane-parallel medium is set up for a monochromatic primary spectral distribution normally incident upon a simi-infinite medium for isotropic scattering. It is treated by a different approach to that previously used by the author, the new approach being based in part on Marshak's method of spherical harmonics. Numerical results are presented for the P_1 approximation to this problem. This result is compared with the corresponding solution obtained previously. The present method shows that the broadening is not as severe as the previous method had indicated. (auth)

RADIATION EFFECTS

2683

THE EFFECTS OF NEUTRON BOMBARDMENT ON A ZINC SULFIDE PHOSPHOR. Alan W. Smith and John Turkevich. J. Chem. Phys. 21, 367-8(1953) Feb.

Neutron bombardment produces marked changes in the properties of Cu-activated ZnS phosphor. The luminescence efficiency decreases exponentially with time of neutron irradiation. While the luminescence of the undamaged sample increases linearly with exciting light intensity, that of the damaged sample depends on the square of the intensity. The effect of the neutron bombardment is more marked the higher the measurement temperature. Effects of annealing and grinding are described. (G.Y.)

RADIOACTIVITY

2684

Radiation Lab., Univ. of Calif., Berkeley

THE RADIOACTIVITY OF Cu^{67}. Harry T. Easterday. Feb. 2, 1953. 9p. (UCRL-2087)

The β spectrum of Cu^{67} is found to contain three groups with maximum energies and relative intensities of 577 kev, 20%; 484 kev, 35%; 395 kev, 45%. Conversion electrons from 92- and 182-kev transitions were observed. These results and the absence of γ-γ coincidences indicate that the β transitions go to the ground and first two excited states of the known Zn^{67} levels. (auth)

2685

INVESTIGATION OF γ RAYS ACCOMPANYING THE TRANSMUTATION $Pa^{231} \xrightarrow{\alpha} Ac^{227}$. Paul Falk-Vairant and Michel Riou. J. phys. radium 14, 65-71(1953) Feb. (In French)

The $Pa^{231} \rightarrow Ac^{227}$ γ rays were measured by simple and selective absorption, and the conversion electrons were studied with a semicircular spectrograph. The data are compared with those from the α fine structure, and the energy levels of Ac^{227} are discussed. (tr-auth)

2686

THE GAMMA-RADIATION FROM Am^{241}. J. O. Newton and B. Rose. Phys. Rev. 89, 1157(1953)

The spectrum of Am^{241} was reexamined in the 26- to 41-kev energy region using proportional counters filled with Kr and Xe. A typical spectrum using a carrier-free Am^{241} source is shown and an upper limit of 0.1% per 59.7-kev γ ray is set for the intensity of γ rays at 33.4 and 38.0 kev. Another spectrum obtained from an Am^{241} source containing La (commonly used as an Am carrier) shows strong lines present at 33.4 and 38.0 kev, having a relative intensity (~5:1) similar to those observed by Browne (UCRL 1764). It is suggested that these are Kα and Kβ radiations of La, excited by the 59.7-kev γ ray, rather than γ-rays as reported by Browne. (L.M.T.)

2687

HEAVY ISOTOPES OF MAGNESIUM AND SILICON. Manfred Lindner. Phys. Rev. 89, 1150(1953) Mar. 1.

After bombarding Cl (as NaCl) with 340-Mev protons, a Mg chemical fraction was found to contain a 21-hr activity with two β particles of ~0.4 and 0.3 Mev and γ's of less than 100 kev and ~1.7 Mev. This activity is attributed to Mg^{28}. A Si fraction removed from the same target showed an abundance of 160-min Si^{31}. A study of the radiations of Mg^{28} and a search for Si^{32} are being continued. (L.M.T.)

2688

THE HALF-LIVES OF SEVERAL RADIOISOTOPES. E. E. Lockett and R. H. Thomas. Nucleonics 11, No. 3, 14-17 (1953) Mar.

The radioactive half-lives of Au^{198}, Bi^{210}, Co^{60}, I^{131}, In^{116}, Mg^{27}, Mn^{56}, Na^{24}, P^{32}, Tl^{204}, and Eu^{152} were determined using a type TQQ beta electroscope. The electroscope consists essentially of a hemispherical air ionization chamber containing a quartz fiber, sputtered with Au, which is charged before the measurement. The source to be measured is introduced to the center of the chamber on a tray, and the rate of discharge of the electroscope is measured by timing the transit of the fiber's image across a scale in the eyepiece of the instrument. (auth)

2689

ATOMIC EXCITATION AND IONIZATION ACCOMPANYING ORBITAL ELECTRON CAPTURE BY NUCLEI. H. Primakoff and F. T. Porter. Phys. Rev. 89, 930-7(1953) Mar. 1.

The process of atomic excitation and ionization accompanying orbital-electron capture by nuclei is treated on the basis of the general theory of β decay using a configuration space representation for both nucleons and leptons. Quantitative expressions are obtained (a) for the total number of double holes produced in the K shell due to K capture accompanied by excitation or ejection of the other K electron, and (b) for the total probability of electron ejection in orbital electron capture together with the ejected electron momentum spectrum. A discussion is given of the possibilities of experimental verification of the theory developed. 17 references. (auth)

2690

CALCULATION OF INTENSITIES OF FINE-STRUCTURE LINES OF SOME EVEN-EVEN α EMITTERS. Paul Falk-Vairant and Jean Teillac. Compt. rend. 236, 914-16(1953) Mar. 2. (In French)

The intensities of the α fine structure lines corresponding to the first excited state for which J = 2 have been calculated by the equations of Preston and Gamow for Po^{206}, ThX (Ra^{224}), Ra^{226}, RdTh (Th^{228}), Io (Th^{230}), Pu^{238}, Pu^{240}, and Cm^{242}. Comparison of the results with experimental data suggests a quasi-stationary state of the α particle in the nucleus, lack of influence of angular momenta in the interior of the nucleus, and the existence of a filled shell for the first five nuclides mentioned. (G.Y)

2691

UPPER LIMIT OF THE HALF LIFE OF THE 11.7-KEV EXCITED STATE OF Ba^{133}. Michel Langevin. Compt. rend. 236, 689-90(1953) Feb. 16. (In French)

The low energy of excitation of the 11.7-kev level of Ba^{133} suggests a half life relatively long with respect to

similar M1 transitions. Measurements of retarded coincidences give an upper limit of 2×10^{-8} sec for the half life of this level. (tr-auth)

2692
CORRECTION APPLIED TO THE THEORETICAL PERIOD-ENERGY RELATION IN α EMISSION BY THE PRESENCE OF THE ELECTRON CORTEGE. Pierrette Benoist-Gueutal. Compt. rend. 236, 691-2(1953) Feb. 16. (In French)

The presence of the external electrons can be taken into account in α decay theory simply by introducing into the usual theoretical expressions for $\lambda(E)$ the energy $E = E_\alpha + E_R + 65.3(Z + 2)^{\frac{1}{3}}$ ev, where E_α is the observed kinetic energy of the α particle, E_R is the kinetic energy of the recoil atom, and Z is the charge of the final nucleus. This correction was used by Asaro et al. (Phys. Rev. 87, 277 (1952); 88, 828(1952)) but the theoretical justification was not published. (tr-auth)

2693
NEW DETERMINATION OF THE ThB (Pb^{212}) HALF LIFE. H. v. Buttlar. Naturwissenschaften 39, 575(1952) Dec. (In German)

Tn was adsorbed on Ni, which was then dissolved in dilute HNO_3 with Pb and Bi carriers. Liquid-counter measurements made 1 day later gave the decay constant $\lambda = 6.498 \pm 0.033 \times 10^{-2}$/hr or a half life of 10.67 ± 0.05 hr for ThB. (G.Y.)

2694
EXPERIMENTAL K TO L + M RATIOS FOR INTERNAL CONVERSION LINES. R. E. Maerker and R. D. Birkhoff. Phys. Rev. 89, 1159(1953) Mar. 1.

Measurements of K/(L + M) of Cs^{137}, Cs^{134} (two lines), Sb^{124}, Nb^{95}, Ba^{140}, and the La^{140} were obtained by means of a β spectrometer of the solenoidal-type described by DeMond (Rev. Sci. Instr. 20, 160, 616(1949)). The results for the two Cs^{134} conversion lines and the 663-kev γ ray in Cs^{137} agree well with measurements previously reported by others. (L.M.T.)

2695
MEASUREMENT OF THE PERIODS OF B^{12} AND Li^8. Pierre Bretonneau. Compt. rend. 236, 913-14(1953) Mar. 2. (In French)

Using an apparatus similar to that described by Vendryes and Lascoux (Compt. rend. 233, 858(1951)) for the measurement of short-lived isomeric states, the author has found the values 0.022 ± 0.001 and 0.875 ± 0.02 sec for the half lives of B^{12} and Li^8, respectively. (G.Y.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2696
OPTICAL DATA FOR RARE EARTH BROMATES. H. Schumann. Z. anorg. u. allgem. Chem. 271, 29-40(1952) Dec. (In German)

Optical properties (refraction, double refraction, optical orientation, axial angle, and dispersion symmetry), as well as cohesion ratios and morphological details were observed for the bromate hydrates of La, Pr, Nd, Sm, Eu, Gd, Tb, Dy, and Er. The microscopic method used is described in detail. (G.Y.)

SHIELDING

2697
INTERLOCKING CONCRETE AND LEAD BLOCKS FOR RADIATION SHIELDING. Clark Goodman and Gardner A. Norton. Nucleonics 11, No. 3, 52-3(1953) Mar.

The concrete blocks interlock in three dimensions when laid up into a shielding wall. They are 8 × 16 × 24 in., hollow, T-shaped and average about 45% concrete and 55% void by volume. Shielding walls made of these blocks are easily constructed, can be easily relocated, and are adaptable to additional shielding by filling in the hollow space from the top. A small-scale mold for casting 2 × 4 × 6 in. Pb blocks of the same interlocking type was fabricated. (L.M.T.)

THEORETICAL PHYSICS

2698
Argonne National Lab.
ON THE ONE-BODY MODEL OF ALPHA RADIOACTIVITY. IIB. S-STATE DECAY WITH THE LIMITING SQUARE WELL MODEL. G. H. Winslow and O. C. Simpson. Jan. 2, 1953. 15p. (ANL-4910)

Bethe's method of derivation is applied to two one-body models of α decay. If the interior potential is a square well but WKB connection formulas are used across the interior classical turning point (the reduction of a rounded interior potential to "practice"), the result is similar to those given by Gamow and Kemble. It yields "correct" nuclear radii but "incorrect" energy levels as compared with the CSW (consistent square well) result. The reasons for the incorrect radii predicted by the Gamow and Kemble expressions are given. Numerical examples are presented. With a truncated cone as an interior potential it is shown that as its sides get steeper the decay constant smoothly approaches that for the square well. (auth)

2699
REMARKS ON THE NUMERICAL VALUES OF THE FERMI FUNCTION. Tosiko Yuasa and Jeanne Laberrigue-Frolow. J. phys. radium 14, 95-9(1953) Feb. (In French)

The numerical values of the Fermi function F(Z,W), occurring in β-decay theory, obtained with Stirling's expansion and infinite products are investigated and compared with the values obtained from several approximate equations (Bethe and Bacher, Nordheim and Yost). The conclusions show that the approximate equation of Nordheim and Yost is not satisfactory below $W = 2m_e c^2$, with $Z > 20$, whereas Bethe and Bacher's equation is satisfactory over a more extended region. The values obtained with Stirling's expansion and infinite products are in agreement over the region considered. ($1.002 \leq W \leq 15\ m_e c^2$; $5 \leq Z \leq 90$). (tr-auth)

2700
STOCHASTIC DEPENDENCE CHARACTER OF HEISENBERG'S UNCERTAINTY RELATION. I. Fényes. Naturwissenschaften 39, 568(1952) Dec. (In German)

2701
HEISENBERG'S UNCERTAINTY RELATION AS A CASE OF STOCHASTIC DEPENDENCE. G. Herdan. Naturwissenschaften 39, 350(1952) Aug. (In English)

2702
POTENTIALS IN THE WAVE MECHANICS OF THE PHOTON AND INTERACTIONS BETWEEN CHARGED PARTICLES. Serge Slansky. Compt. rend. 236, 782-4(1953) Feb. 23. (In French)

A modification of the operators occurring in the expressions for the potentials of a photon permits the elimination of the infinite term known as the "coincidence potential" in the electrostatic interactions by exchange of longitudinal photons. This result makes probable the existence of a "pseudoscalar" photon of spin 0. (tr-auth)

2703
NEW EQUATION IN THE AFFINE FIELD LAWS. G. Bandyopadhyay. Phys. Rev. 89, 1161(1953) Mar. 1.

In his recent affine field theory based on nonsymmetric affinities, Schroedinger deduced his field equations from a variation principle. It is suggested here that the field equations should be obtained from two variation principles instead of one. (auth)

2704

DIVERGENCE OF PERTURBATION EXPANSION. A. Petermann. Phys. Rev. 89, 1160-1(1953) Mar. 1.

The difficulties encountered in quantum field theory in the ultraviolet region have been successfully resolved by the normalization technique. The problem of convergence after renormalization of the power series expansions encountered in calculating physical quantities has not been resolved, however, and a direct proof of divergence is presented, namely, the calculation of a Green's function in electrodynamics. (L.M.T.)

2705

NUCLEAR CONSTITUTION AND THE INTERPRETATION OF FISSION PHENOMENA. David Lawrence Hill and John Archibald Wheeler. Phys. Rev. 89, 1102-45(1953) Mar. 1.

An attempt is made to correlate in a unified picture the features of the empirical evidence on nuclear constitution, some of which appear to require for their explanation the liquid drop model as others require the independent particle picture. As an idealized and exploratory basis for an inclusive description, the extreme saturation assumption has been adopted: potential on a typical nucleon in the nuclear interior nearly independent of the position of the other nucleons, this potential falling off in a small distance at the nuclear surface. In the resulting "collective model" of the nucleus a distinction is made between the nucleonic state of the system – as defined by the states occupied by the individual nucleons – and the state of vibration and rotation of the nucleus as a whole. On quantum-mechanical grounds it is shown how the kinetic energy of this motion receives an explanation in terms of the degree of freedom of the individual particles. Discussed are some consequences of the collective model or of its liquid drop simplification for energy levels, compatibility of strong neutron capture with individual particle effects in binding, quadrupole moments, alpha-decay, fission thresholds, photofission, spontaneous fission, asymmetry in nuclear fission, hydrodynamics of the division process, fission alpha-particles, and fragment excitation. (auth)

2706

RELATIVISTIC STATISTICAL THERMODYNAMICS. A. E. Scheidegger and R. V. Krotkov. Phys. Rev. 89, 1096-1100 (1953) Mar. 1.

Bergmann has generalized Gibbs' classical statistical mechanics so as to make it applicable to both relativistic and quantum-mechanical system. His method, however, involves some complicated differential geometry, and the resulting formulas are not easily manageable. A different method for obtaining a relativistic and quantized statistical thermodynamics is proposed which avoids the differential geometry and gives simpler final formulas. The end results agree with the usual phenomenological relativistic thermodynamics, in which the entropy is a relativistic invariant, while heat and inverse temperature are generalized to be quadrivectors. (auth)

2707

BOHM'S INTERPRETATION OF THE QUANTUM THEORY IN TERMS OF "HIDDEN" VARIABLES. Joseph B. Keller. Phys. Rev. 89, 1040-1(1953) Mar. 1.

An analysis is presented of Bohm's theory, emphasizing the role of probability in it. (auth)

2708

ELEMENTS OF THE NUCLEAR MATRIX OF β TRANSITIONS FOR ODD NUCLEI. R. Nataf. J. phys. radium 14, 72-7(1953) Feb. (In French)

Using a single-particle model with a central potential of unspecified form, the author calculates the angular factors of the nuclear matrix elements for the different permitted or forbidden transitions, assuming generally a pure T interaction. (tr-auth)

2709

PAIR CREATION IN INTERMEDIATE COUPLING THEORY. R G. Moorhouse. Phys. Rev. 89, 958-65(1953) Mar. 1.

The approximations of the intermediate coupling method are applied to a model of the self-field of a single nucleon (interacting with a pseudoscalar-meson field) in which only processes involving pair creation and annihilation are allowed. In order to do this a method of subtracting the vacuum, before these approximations are made, is suggested. The magnetic moment of the self-field on this model is investigated, and a comparison is made with the antithetic model of the self-field in which only processes not involving pair creation or annihilation are allowed. (auth)

2710

FIRST-ORDER MESON WAVE EQUATIONS. H. S. Green. Phys. Rev. 89, 965-7(1953) Mar. 1.

A method is developed for the simple representation of the symbols introduced in the generalization of Dirac's first-order wave equation for the electron. This enables one to obtain an explicit general solution of the generalized equations. The sign of the energy is discussed in order to determine which of the various possible representations are physically admissible. (auth)

2711

THE EVALUATION OF THE ENERGY MATRIX OF THE TENSOR FORCES. Igal Talmi. Phys. Rev. 89, 1065-71 (1953) Mar. 1.

It is shown how the use of tensor operators enables a simple calculation of the tensor forces in nuclear configurations by the usual spectroscopic methods. The number of independent parameters necessary to define the energy in the nuclear configuration l^n (or j^n) is found to be $2l$ (or $2j$), whereas it is shown to be only $[4l/3]$ (or $[2j + 2/3]$) in the l^n (or j^n) configuration of equivalent nucleons. The energy matrix is given by means of a closed formula for the case of d^n and $(d_{5/2})^n$ configurations (of equivalent nucleons). It is found that in the latter configuration the order of levels for a short-range potential (or the tensor forces) is the same as for short-range central forces. (auth)

2712

S-MATRIX AND CAUSALITY CONDITION. I. MAXWELL FIELD. N. G. van Kampen. Phys. Rev. 89, 1072-9(1953) Mar. 1.

The general aim is to obtain maximum information about the S matrix with a minimum of assumptions concerning the interaction. This program is carried through for the scattering of the electromagnetic field by a fixed center. The center is assumed spherically symmetric and of finite size, so that the causality condition can be applied. From this condition it follows rigorously that the S matrix has a one-valued analytic continuation, whose only singularities are poles in the lower half plane, and whose behavior at infinity can be specified. Particular consequences are: (1) the analytic properties of Wigner's function R; (2) the integral relation connecting real and imaginary parts of S; (3) relations connecting the sum of the oscillator strengths with the scattering cross section. (auth)

2713

QUANTUM FIELD THEORY IN THE LIGHT OF DISTRIBUTION ANALYSIS. Werner Guttinger. Phys. Rev. 89, 1004-19(1953) Mar. 1.

It is shown that part of the divergences and ambiguities of the current quantum theory of fields can be overcome by the consistent use of distribution analysis. Representing the singular functions of field theory by distributions, nongage invariant and nonequivalent terms will be eliminated

from the S matrix in renormalizable as well as in non-renormalizable theories without any limiting process. Instead of divergent quantities, there appear arbitrary normalization and division constants. Feynman's cutoff as well as the renormalization are automatically contained in a theory which gives a correct meaning to delta functions. Applications to closed-loop processes are discussed in detail. It is not possible to attribute definite values to the parameters of bare particles; for that, some modifications of the theory seem to be necessary. 18 references. (auth)

URANIUM AND URANIUM COMPOUNDS

2714

URANIUM PHOTOFISSION YIELDS. Roman A. Schmitt and Nathan Sugarman. Phys. Rev. 89, 1155-6(1953) Mar. 1.

The photofission of U was studied by means of a betatron with a beam intensity of 300 r/min, 1 m from the target. Ten g of $UO_2(NO_3)_2$ was irradiated with the half-angle of the x-ray beam about 32 cm from the W target for periods of 10 min to 2 days. Radiochemical analyses were employed to isolate the desired nuclides which were counted with a G-M β counter. In addition, ~2 g of $UO_2(NO_3)_2$ was irradiated in the thermal column of the Argonne heavy-water pile and the same nuclides studied as in the betatron irradiations. The photoyield curve is shown for the 48-Mev x rays and comparison is made with the thermal-neutron fission-yield curve of U^{235}. Some results on the yields of selected peak and through nuclides at 22 and 100 Mev are shown. In addition, the peak-to-trough ratios for U^{235}, U^{238}, and Th^{232}, at various x-ray energies are listed. 15 references. (L.M.T.)

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1570	2,p.42	Blood, 3, 729-54(1948)
NAA-SR	NSA	
178	6-3572	Rev. Sci. Instruments 24, 80-1(1953)
NYO		
793	6-1400	Anal. Chem. 25, 482-6(1953)
3001	6-2740	Phys. Rev. 85, 489-90(1952)
ORNL		
1347	6-6689	$0.20
1405	7-626	$0.20
UCLA		
134	5-4105	Rev. Sci. Instruments 24, 78-9(1953)
220	6-5887	Rev. Sci. Instruments 24, 73-4(1953)
224	7-40	Proc. Soc. Exptl. Biol. Med. 81, 665-7 (1952)
UCRL		
1795	6-4083	Elec. Eng. 72, 212-18(1953)

Report	Abstract	Availability
UCRL	NSA	
1863	7-1631	$0.25
1937	6-6696	Phys. Rev. 89, 1019-22(1953)
1955	7-41	Nucleonics 11, No. 3, 56, 58(1953)
2004	7-1095	$0.20
2037	7-1519	$0.20
2060	7-1835	$0.55
2079	7-1839	$0.10
UR		
78	3-1623	Science 111, 117-8(1950)
132	5-1249	J. Am. Chem. Soc. 73, 1212-15(1951)
142(p.29-40)	5-2369	Am. J. Physiol. 163, 715(1950); J. Pharmacol. Exptl. Therap. 101, 14(1951)
176	5-4308	J. Biol. Chem. 193, 243-51(1953)
185	6-2560	Biochim et Biophys. Acta 8, 369-74(1952)
187	5-6953	Proc. Soc. Exptl. Biol. Med. 78, 687-9 (1951)
213(p.56)	6-5541	Federation Proc. 11, 133(1952)
213(p.57)	6-5541	Federation Proc. 11, 183(1952)
213(p.58)	6-5541	Federation Proc. 11, 278(1952)
213(p.59)	6-5541	Federation Proc. 11, 280(1952)
213(p.60)	6-5541	Federation Proc. 11, 260(1952)
213(p.61)	6-5541	Federation Proc. 11, 182(1952)
213(p.62)	6-5541	Federation Proc. 11, 299(1952)
213(p.63)	6-5541	Federation Proc. 11, 4(1952)
213(p.64)	6-5541	Federation Proc. 11, 114(1952)
213(p.65)	6-5541	Federation Proc. 11, 423(1952)
213(p.66)	6-5541	Federation Proc. 11, 359(1952)
213(p.67)	6-5541	Federation Proc. 11, 416(1952)
213(p.68)	6-5541	Federation Proc. 11, 278(1952)
213(p.69)	6-5541	Federation Proc. 11, 162(1952)
USNRDL		
340	6-3490	J. Aviation Med. 24, 57-62(1953)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses.

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers.

For a list of the abbreviations used in this section, see NSA, Vol. 7, No. 1, page "SUPPLEMENT 1".

$_{2}He^{4}$

$H^3(p,\gamma)$ E_p = 1 to 5.2
No resonance for production of ~20-Mev γ's
γ yield curve flattens at ~E_p = 3.5

H.B.Willard, J.K.Bair, J.D.Kington, ORNL-1415, 3(1952).

$He^3(d,p)$ E_d = 10.2 ppl
No level below 20.9 Mev ($d\sigma/d\Omega$ for excited state < 0.2 mb/sterad. at 90° lab.)

J.C.Allred, Phys. Rev. 84, 695(1951).

$He^4(p,p')$ E_p = 32 pc
No level below 23.3 Mev ($d\sigma/d\Omega$ for low energy p group < 0.1 mb/sterad. at 45° c.m.)

J.Benveniste, B.Cork, Phys. Rev. 89, 422(1953).

$_{2}He^{5}$

Levels $H^3(He^3,p)$ E_{He^3} = 0.30 scin
g.s. group observed at E_p = 9.05
No other p group found

W.M.Good, W.E.Kunz, C.D.Moak, ORNL-1415(1952).

$_{3}Li^{6}$

No reaction $Li^6(\gamma,d)He^4$
$\sigma < \sim 6 \times 10^{-6}$ for E_γ = 2.76, ~7, 17.6
Isotopic spin forbidden*

*A.Bamba, V.Wataghin, Nuovo Cim. 10, 174(1953). E.W.Titterton, T.A.Brinkley, Proc. Phys. Soc. 65A, 1052(1952).

$_{3}Li^{7}$

Levels $B^{10}(n,\alpha)$ E_n = th pc
5.8† g.s.
94.2† (0.48)
† Relative cross sections

U.H.Hauser, Z. Naturf. 7a, 781(1952).

Level $Li^6(d,p\gamma)$ E_d = 0.41
$p\gamma(\theta)$ (0.478) I = 1/2

A.J.Salmon, E.K.Inall, Proc. Phys. Soc. 66A, 297(1953).

Level $Li^6(n,t)He^4$ E_n = 0.27 ppl
n,t(θ) (7.4) J = 5/2

W.O.Soiano, J.M.Roberts, Phys. Rev. 89, 892A (1953).

$_{3}Li^{7}$

Levels $Li^7(\gamma,\alpha)H^3$ E_γ = 6.13 ppl
$\gamma,\alpha(\theta)$ suggests 3/2 +, 1/2 − interference
$\sigma = 2.7 \times 10^{-5}$

M.Nabholz, P.Stoll, M.Wäffler, Helv. Phys. Acta 25, 701(1952).

Resonances $Li^7(\gamma,t)He^4$ E_γ ≤ 24 ppl
9.3 21.5 ?
16.7 ? 23.5 ?
No structure resolved for $Li^7(\gamma,p)He^6$

E.W.Titterton, T.A.Brinkley, Proc. Phys. Soc. 66A 194(1953).

$_{3}Li^{8}$

τ 0.87^{s} Li(0.6-Mev d)

P.Bretonneau, Compt. rend. 236, 913(1953).

I 3 ? $Li^7(d,p)$ scin
(12.5β)(1.5α)(θ) consistent with
I = 3, 2, 0 and not I = 0, 2, 0

C.M.Class, S.S.Hanna, Phys. Rev. 89, 877(1953).

$_{4}Be^{7}$

No reaction observed for He(α,n)
$\sigma < 7 \times 10^{-4}$ for E_α = 39 (threshold = 38)
Consistent with odd parity for g.s.

D.Walker, W.T.Link, W.I.B.Smith, Proc. Phys. Soc. 65A, 861(1952).

$_{4}Be^{8}$

Levels $Li^6(He^3,p)$ E_{He^3} = 0.72 scin
g.s.
3.2
Only two peaks at E_p = 14.6, 12.0

W.M.Good, W.E.Kunz, C.D.Moak, ORNL-1415(1952).

Levels $Li^7(d,n)$ E_d = 0.68 ppl
2.2 ?* 4.1
2.9 5.0
*Seen for small angles only
d,n(θ) shows both stripping and compound nucleus formation

B.Trumpy, T.Grotdal, A.Graue, Nature 170, 1118 (1952).

$_4Be^8$

Level $Li^7(d,p\beta^-)2\alpha$ scin
(~3) I = 2
$(12.5\beta)(1.5\alpha)(\theta)$ consistent with I = 3, 2, 0

C.W.Class, S.S.Manna, Phys. Rev. 89, 877(1953).

Level $Be^9(d,t)$ ppl
g.s.
$d,t(\theta)$ for E_d = 0.295, 0.40, 0.45, 0.52, 0.62

D.deJong, P.M.Endt, L.J.G.Simons, Physica 18, 676(1952).

Levels $B^{10}(d,\alpha)$ E_d = 0.59, 0.78, 1.07 ic
g.s
2.9 I = 2*
*From fit of theoretical curve to α energy spectrum
Only two α peaks at $E_\alpha \sim 12, \sim 9$

P.B.Treacy, Phil. Mag. 44, 325(1953).

$_4Be^{10}_6$

Capture γ's $Be^9(n,\gamma)$ pair s
25 † 3.41
75 † 6.81
No 6.3γ observed
†Photons per 100 n captures

G.A.Bartholomew, E.B.Kinsey, Can. J. Phys. 31, 49(1953).

Level Be(d,p) ppl
g.s.
$d,p(\theta)$ for E_d = 0.295, 0.40, 0.45, 0.52, 0.62

D.deJong, P.M.Endt, L.J.G.Simons, Physica 18, 676(1952).

$_5B^{10}_5$

Level B(n,nγ) E_n = 2.5
γ 0.717 scin

R.B.Day, Phys. Rev. 89, 908A(1953).

$_5B^{11}_6$

$Be^9(d,t)Be^8$ E_d = 1.3 ppl
$d,t(\theta)$ shows forward peaking suggesting pick-up

P.Cuer, J.J.Jung, Phys. Rev. 89, 1151(1953).

$Be^9(d,t)Be^8$ $Be^9(d,p)Be^{10}$
σ's equal for E_d < 0.40 ppl

D.deJong, P.M.Endt, L.J.G.Simons, Physica 18, 676(1952).

$_5B^{12}_7$

τ 0.022^s B(0.6-Mev d)

P.Bretonneau, Compt. rend. 236, 913(1953).

$_6C^{11}_5$

τ 20.25^m C^{12}(30-Mev p) scin

W.W.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952).

τ 20.74^m C(21-Mev He^3)

D.N.Kundu, T.W.Donaven, N.L.Pool, J.K.Long, Phys. Rev. 89, 1200(1953); Physica 18, 1304(1952).

$_6C^{12}_6$

Levels $B^{11}(d,n)$ E_d = 8.1 ppl
g.s. $l_p = 1$
(4.43) $l_p = 1$

L.W.Gibson, Phil. Mag. 44, 297(1953).

$_6C^{12}_6$

Level $C^{12}(p,p\gamma)$ E_p = 7.1 scin
$p,\gamma(\theta)$ (4.43) I = 2

N.E.Gove, N.S.Wall, Can J. Phys. 31, 189(1953).

Level $C^{12}(n,n\gamma)$ E_n = 5.5
γ 4.45 scin

R.B.Day, Phys. Rev. 89, 908A(1953).

Levels $B^{11}(p,\gamma)$ E_p = 0.7
(~16.1)
$p,\gamma(\theta)$ for 11.8γ indicates interference between levels of opposite parity

G.L.Jenkins, L.W.Cochran, H.W.Given, J.L.Ryan, T.W.Mahn, B.D.Kern, BAPS 28, 2, DA7(1953).

$C^{12}(\gamma,\alpha)Be^8$ E_γ = 17.6 ppl
$\sigma(Be^8$ g.s.$)/\sigma(Be^8 \sim$3-Mev level) = 0.025 (cf O^{16})

H.Nabholz, P.Stoll, H.Wäffler, Helv. Phys. Acta 25, 701(1952).

Levels $C^{12}(\gamma,3\alpha)$ $E_\gamma \leq 70$ ppl
18 others ? 310 stars
29

W.K.Dawson, C.B.Bigham, Can. J. Phys. 31, 167 (1953).

$_6C^{13}_7$

Capture γ's $C^{12}(n,\gamma)$ pair s
30 † 3.68
70 † 4.95
No 3.9γ observed (< 6†)
† Photons per 100 n captures

G.A.Bartholomew, E.B.Kinsey, Can. J. Phys. 31, 49(1953).

$_6C^{14}_8$

F-K plot concave toward energy axis below 50 kev although S^{35} and Pm^{147} plots linear to 10 kev

J.P.Wize, D.J.Zaffarano, BAPS 28, 2 DA6(1953).

$_8O^{15}_7$

Levels $N^{14}(d,n)$ E_d = 7.7 ppl
g.s. $l_p = 1$
5.3 $l_p = 2$?
6.2 $l_p = 1$?
6.8 $l_p = 0$
7.5 $l_p = 1$?
8.4 $l_p = 1$?
9.1 $l_p = 1$?

W.M.Evans, T.S.Green, R.Middleton, Proc. Phys. Soc. 66A, 108(1953).

$_8O^{16}_8$

Levels $N^{15}(p,\alpha\gamma)C^{12}$ scin
$p,\gamma(\theta)$ (12.51) J = 2-
(12.95) J = 2-
(13.24) J = 3- or 4+
4.43γ studied for E_p = 0.43, 0.90, 1.2

C.A.Barnes, D.B.James, G.C.Neilson, Can. J. Phys. 30, 717(1952).

Levels $O^{16}(n,n)$ E_n = 14.1 cc
(~6 Mev excitation)/(~12 Mev excitation) ~5

J.P.Conner, Phys. Rev. 89, 712(1953).

$_{8}O^{16}_{8}$ $O^{16}(\gamma,\alpha)C^{12}$ $E_\gamma = 17.6$ ppl

$\sigma(C^{12}$ g.s.$)/\sigma(C^{12}$ 4.4-Mev level$) > 30$ (cf C^{12})

$\sigma(C^{12}$ g.s.$) = 2.0 \times 10^{-4}$

H.Nabholz, P.Stoll, H.Wäffler, Helv. Phys. Acta 25, 701(1952).

$_{8}O^{17}_{9}$ Level $N^{14}(\alpha,p)$ $E_\alpha = 4.80$ ppl

0.86

E.Hjalmar, M.Siätis, Phys. Rev. 89, 1151(1953).

$O^{16}(n,n)$ $E_n = 14.1$ cc

n,n(θ) asymmetrical for elastic n's, ~symmetrical for inelastic

J.P.Conner, Phys. Rev. 89, 712(1953).

$_{9}F^{19}_{10}$ γ's $F^{19}(n,n\gamma)$ $E_n = 2.5$ scin

0.084
0.114
0.199
1.36

R.B.Day, Phys. Rev. 89, 908A(1953).

$_{10}Ne^{20}_{10}$ Level $Na^{23}(p,\alpha)$ $E_p = 1.46, 2.92$ EA

1.634

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

Levels	$O^{16}(\alpha,\alpha)$	
$\alpha,\alpha(\theta)$	**6.738**	**J = 0**
	7.182	**J = 3**
	7.218	**J = 0**
	7.450	**J = 2**
	7.854	**J = 2**

J.R.Cameron, R.H.Davis, A.S.Divatia, F.J.Epping, R.W.Hill, Phys. Rev. 89, 909A(1953).

$_{11}Na^{22}_{11}$ $(0.56\beta^+)/(1.82\beta^+) \sim 1800$ s

B.T.Wright, Phys. Rev. 89, 902A(1953).

$_{11}Na^{23}_{12}$ Level $Na^{23}(p,p)$ $E_p = 1.46$ EA

0.439

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

$_{11}Na^{24}_{13}$ I **4** M

μ **+1.690**

$\Delta F = \pm 1, \Delta m = \pm 1$ transitions studied

$\Delta\nu(Na^{24})/\Delta\nu(Na^{23}) = 1139.35/1771.61$

E.H.Bellamy, K.F.Smith, Phil. Mag. 44, 33(1953).

$_{12}Mg^{24}_{12}$ Level $Mg(n,n\gamma)$ $E_n = 2.5$

γ **1.365** scin

R.B.Day, Phys. Rev. 89, 908A(1953).

Level $Mg(p,p)$ $E_p = 2.41$ EA

1.371 ± 0.002

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

$_{12}Mg^{24}_{12}$ Capture γ's $Na^{23}(p,\gamma)$ $E_p = 0.305$ scin

28 †	**1.38**	**≤5** †	**5.8**
≤4 †	**2.41 ?**	**≤2** †	**6.2**
24 †	**2.88 ?**	**20** †	**6.8**
	~3.6		**7.5**
	4.2	**11** †	**10.3**

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809 (1953).

$_{12}Mg^{25}_{13}$ Levels $Mg^{24}(d,p)$ $E_d = 8$ pc

d,p(θ) **15.4** †	g.s.	$l_n = 2$
8.2 †	(0.58)	$l_n = 0$
8.2 †	(0.98)	$l_n = 0$
	(1.81)	isotropic
5.5 †	(1.96)	$l_n = 2$
	(~2.7)	$l_n = 0$
8.7 †	(3.40)	$l_n = 1$
	4.62	
	5.05	
	5.49	
	6.40	

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 258 (1953).

$_{12}Mg^{26}_{14}$ Levels $Mg^{25}(d,p)$ $E_d = 8$ pc

d,p(θ) ~2 †	g.s.	
13 †	(1.83)	$l_n = 0(60\%), 2(40\%)$
5.7 †	(2.97)	$l_n = 0$
6.1 †	(3.87)	$l_n = 0$
5.6 †	(4.35)	$l_n = 0$
3.3 †	(6.15)	$l_n = 0$
	7.29	
	8.28	

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 258 (1953).

$_{12}Mg^{27}_{15}$ τ **9.39^m** ± 0.03 Mg(pile n)

Counted with β electroscope

K.J.Bobin, E.E.Lockett, quoted by E.E.Lockett, R.M.Thomas, Nucleonics 11, No. 3, 14(1953).

τ **9.45^m** ± 0.03 Mg(pile n)

Counted with β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Levels	$Mg^{26}(d,p)$	$E_d = 8$	pc
d,p(θ) **2.8** †	g.s.	$l_n = 0$	
4.8 †	(0.99)	$l_n = 2$	
	3.50	$l_n = 0$	

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 258(1953).

$_{12}Mg^{28}_{16}$ τ **21^h** p 2.3^{m}Al, Cl(340-Mev p), chem

β^- **~0.4**

γ **<0.1**

M.Lindner, Phys. Rev. 83, 1150(1951).

Al^{25} (13 12)

Levels	$Mg^{24}(d,n)$	$E_d = 3.97$	ppl
d,n(θ)	g.s.	$l_p = 2$	
	0.45	$l_p = 0$	
	0.95	$l_p = 1$ or 2	
	1.81		
	1.94 ?		
	2.51		
	2.70		
	2.92 ?		
	3.09		

E.Goldberg, Phys. Rev. 88, 159A(1952); 89, 760 (1953).

Capture γ's	$Mg(p,\gamma)$	$E_p = 0.27$	scin
~6 †	0.48		
6 †	1.95		
2 †	2.35		

No higher energy γ's observed

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809 (1953).

Al^{27} (13 14)

Level	$Al^{27}(p,p)$	$E_p = 2.31$	EA
	0.843		

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

Levels	$Al^{27}(n,n\gamma)$	$E_n = 2.5$	scin
γ	0.843		
	1.018		
	2.20		

R.B.Day, Phys. Rev. 89, 908A(1953).

Si^{28} (14 14)

Capture γ's	$Al^{27}(p,\gamma)$	$E_p = 0.325, 0.404$	
12 †	1.81	~14 † { 7.1	scin
12 †	2.82	{ 7.5	
ε † {	4.65		
	5.0		

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809 (1953).

Si^{32} (14 18)

τ ≤ 2.6^h or > 100^y Cl(340-Mev p), 2.6^h Si^{31} observed in high abundance chem

W.Lindner, Phys. Rev. 89, 1150(1953).

Neutron Cross Sections

Reaction	σ Type	Value	Energy	Ref.
H(n)	σ_t	2.525	2.532	53f2
	σ_t	graph	3 - 13	53n1
	σ_t	0.057	126	53t2
Be(n)	σ_t	graph	3 - 13	53n1
C(n)	σ_t	graph	3 - 13	53n1
	σ_t	graph	30-139	53t2
$N^{14}(n,2n)$	$\sigma(10^mN)$	5.7 mb	14.5	53p1
O(n)	σ_{el}	0.7	14.1	53c3
O(n,<14.1n)	σ_{in}	0.5	14.1	53c3
O(n)	σ_t	graph	3 - 13	53n1
	σ_t	1.6	14.1	53c3
$O^{16}(n,p)$	$\sigma(7.3^sN)$	49 mb	14.5	53p1
$F^{19}(n,2n)$	$\sigma(1.9^hF)$	61 mb	14.5	53p1
$F^{19}(n,p)$	$\sigma(30^sO)$	130 mb	14.5	53p1
$Na^{23}(n,p)$	$\sigma(40^sNe)$	34 mb	14.5	53p1
$Na^{23}(n,\gamma)$	$\sigma(15.0^hNa)$	0.53	th	53b2
$Mg^{24}(n,p)$	$\sigma(15.0^hNa)$	190 mb	14.5	53p1
$Mg^{25}(n,p)$	$\sigma(62^sNa)$	45 mb	14.5	53p1
Al(n)	σ_t	graph	3 - 13	53n1
	σ_t	graph	30-139	53t2
$Al^{27}(n,\alpha)$	$\sigma(15.0^hNa)$	79 mb	14.5	53p1
$Al^{27}(n,p)$	$\sigma(9.5^mMg)$	52 mb	14.5	53p1
Si(n)	σ_t	graph	3 - 13	53n1
$Si^{28}(n,p)$	$\sigma(2.4^mAl)$	220 mb	14.5	53p1
$Si^{29}(n,p)$	$\sigma(6.6^mAl)$	100 mb	14.5	53p1
$Si^{30}(n,\alpha)$	$\sigma(9.5^mMg)$	46 mb	14.5	53p1

53b2 R.W.Bartholomew, R.C.Hawkins, W.F.Merritt, L.Yaffe, Can. J. Chem. 31, 204(1953). Based on $\sigma_a(Au)$=93.

53c3 J.P.Conner, Phys. Rev. 89, 712(1953).

53f2 M.E.Fields, R.L.Becker, R.K.Adair, Phys. Rev. 89, 908 (1953).

53n1 N.Nereson, S.Darden, Phys. Rev. 89, 775(1953).

53p1 E.B.Paul, R.L.Clarke, Can. J. Phys. 31, 267(1953).

53t2 A.E.Taylor, E.Wood, Phil. Mag. 44, 95(1953).

Ground State Q's, Mass Ratios

Reaction	Standard	Value	Method	Ref.
$B^{10}(n,\alpha)Li^7$	Po^{212} α	+ 2.781 ±0.025	pc	52h7
$B^{10}(d,\alpha)Be^8$	Bi^{212} Po^{212} α	+ 17.91 ±0.06	ic	53t3
$N^{14}(d,n)O^{15}$		+ 5.15 ±0.16	ppl	53e2
$N^{14}(\alpha,p)O^{17}$		- 1.16	ppl	53h4
$Na^{23}(p,\alpha)Ne^{20}$	$Li^7(p,n)$	+ 2.379 ±0.003	EA	53d1
$Mg^{24}(p,\gamma)Al^{25}$	$F(p,\alpha)$	+ 2.32 ±0.10	scin	53c2
$Mg^{24}(d,n)Al^{25}$		+ 0.07 ±0.06	ppl	53g2
$Mg^{26}(p,\gamma)Al^{27}$	$F(p,\alpha)$	+ 8.3 ±0.4	scin	53c2
$Al^{27}(p,\alpha)Mg^{24}$	$Li^7(p,n)$	+ 1.594 ±0.002	EA	53d1
$S^{32}(d,n)Cl^{33}$		+ 0.25 ±0.07	ppl	53m2
Mass (S^{32})/Mass (S^{34})		1.06242	Mic	53b3

52h7 U.A.Hauser, Z. Naturf. 7a, 781(1952).

53b3 G.R.Bird, R.C.Mockler, BAPS 28, 2, J7(1953).

53c2 H.Casson, Phys. Rev. 89, 809(1953).

53d1 D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.J.Richards, Phys. Rev. 89, 824(1953).

53e2 W.H.Evans, T.S.Green, R.Middleton, Proc. Phys. Soc. 66A, 108(1953).

53g2 E.Goldberg, Phys. Rev. 89, 760(1953).

53h4 E.Hjalmar, H.Slätis, Phys. Rev. 89, 1151(1953).

53m2 R.Middleton, F.A.El-Bedewi, C.T.Tai, Proc. Phys. Soc. 66A, 95(1953).

53t3 P.B.Treacy, Phil. Mag. 44, 325(1953).